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APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

ACCUMULATOR SELECTION . . . "THE RULE OF THREE" Page 57

AUTOMATIC BLEEDING OF AIR IN HYDRAULIC SYSTEMS Page 62

CENTRAL POWER SOURCE ON MACHINE TOOLS Page 66

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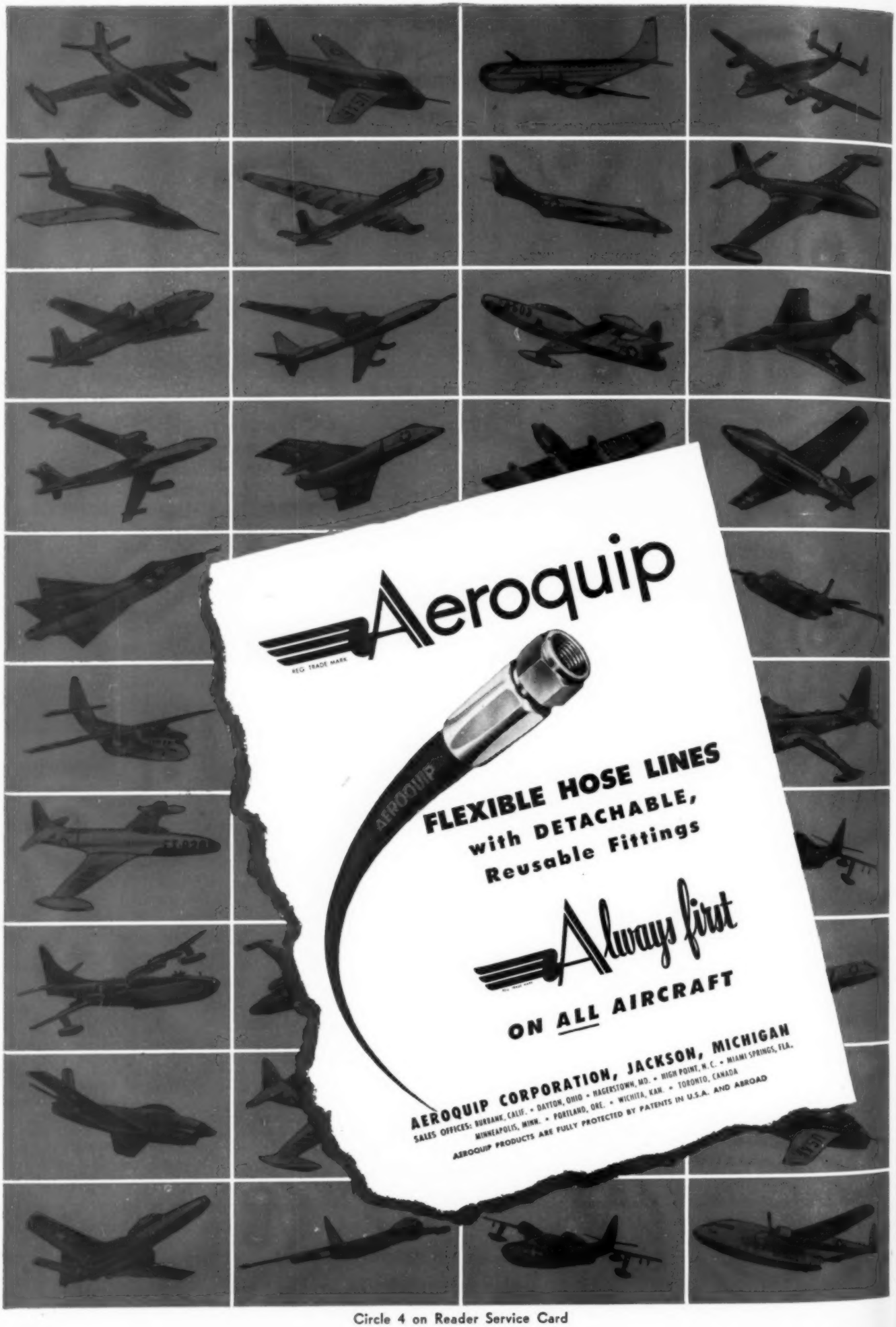
Listed on page 2 you'll find 14 articles and 7 regular departments which feature application and design ideas for fluid power equipment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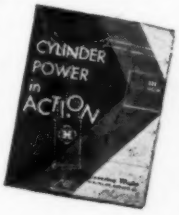

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JUNE, 1953
Vol. 6, No. 6

APPLIED HYDRAULICS

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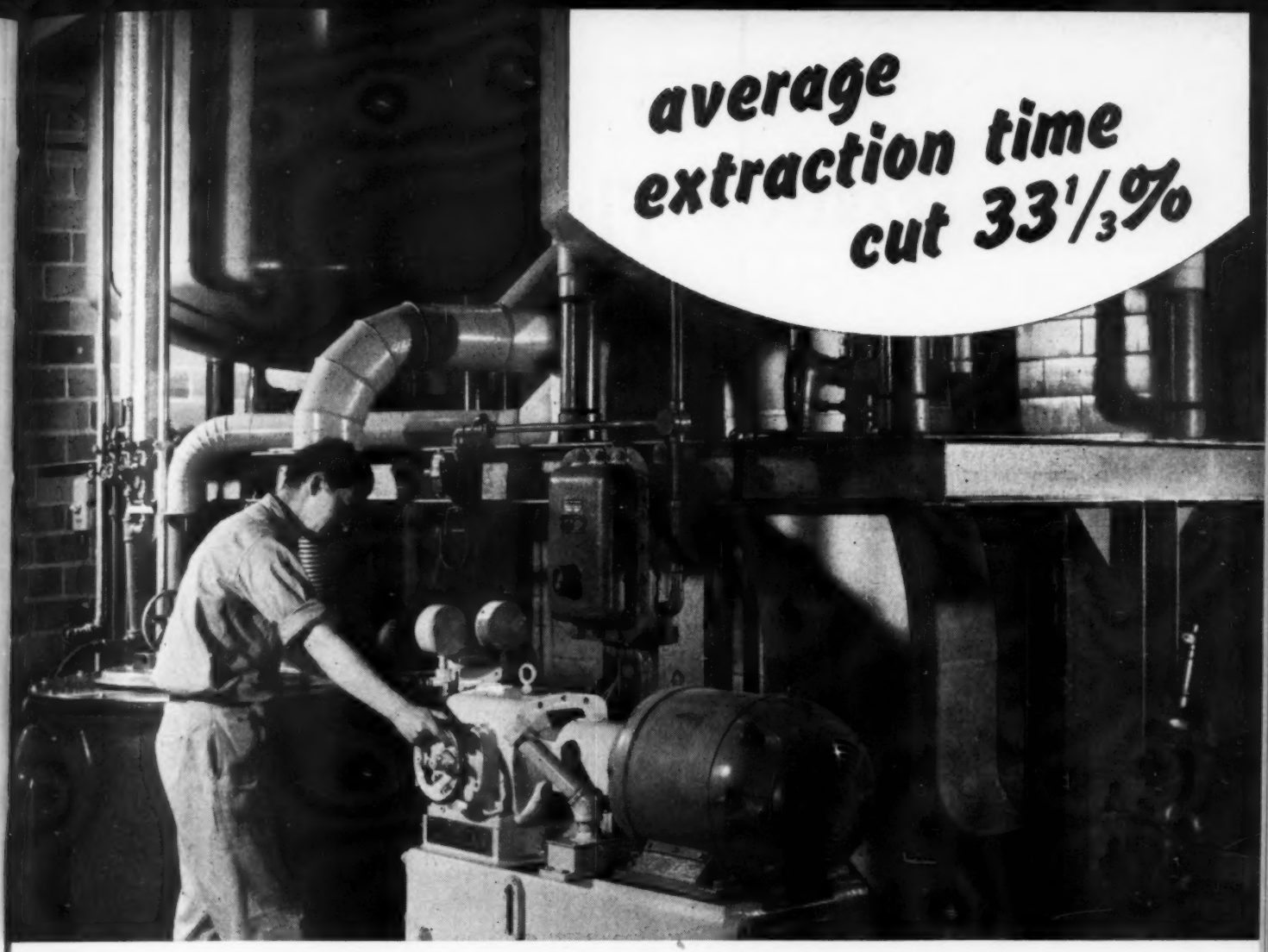

Once more the ANY-SPEED Oilgear Drive betters machine performance "painlessly"

Many times in our experience the performance of an already highly efficient machine has been bettered without redesign, solely by changing the drive. One case out of many *varied* cases, is the Tolhurst Centrifugal pictured above, located in a great pharmaceutical house. This centrifugal was originally equipped with a two-speed electric motor drive. However the chemicals it is called upon to handle have widely varying crystal packing characteristics. Some of these crystals packed so densely at the speed available, extraction was inhibited, extraction time far out of balance and crystal removal difficult.

A change was made to an *"ANY-SPEED"* Oilgear Fluid Power Drive. Now the operator is able to shade the speed of the centrifuge experimentally—*and easily discover* the *best* speed for each batch of crystals.

As a result, extracting that used to take from 6 to 9 hours was cut to 4 to 6 hours. The extremely slow speed also available made unloading a great deal easier. This user now has several other Oilgear drives including one on a laboratory centrifuge.

There is very often a direct efficiency coefficient between machine operating speed and the type of work being handled. And we can cite many widely varying instances where equally dramatic and profitable gains resulted at once from a simple change to *"ANY-SPEED"* Oilgear Fluid Power Drives. If you want some interesting factual data on Oilgear's steplessly variable speed drives, their outstanding responsiveness to control impulses, their smooth acceleration and deceleration, talk to an Oilgear Engineering Representative. His mature and sound engineering recommendations may profit you greatly. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wisconsin.

OILGEAR

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Fluid Power Lines

Who's Sugar?

We aren't sure whether the heckler said, "Who's sugar?" or "Whose sugar?", when he peeked over our typewriter at Earl Drollinger's article which was originally titled "Put the Squeeze on Sugar". So to avoid any embarrassment and at the same time to be more accurate, the title was changed to "Put the Squeeze on Sugar Cane".

When we talked with Earl Drollinger at the Squire Corporation plant in Buffalo, we came away with an extra little story about the problems of selling machinery in countries where mechanical know-how is not widespread. Some years ago when it became economical to use machined gears in place of cast gears, this change was made without notifying the customer because the benefits were so obvious. When the machine went into operation on a South American plantation, the plantation manager, whose house was located a half mile from the mill, complained that it was now impossible to hear if the mill was going.

Further, his wife could not sleep: the quiet was too much for her. Maybe a good merchandising slogan like: "A cowbell with every model" was needed. Did I hear you say, "Whose model?"

Goin' Up in the World

While there are faster ways to go up in the air than with hydraulic jacks, we still found that experience of moving 30 feet off the ground along with a 50 ton concrete slab is on the fabulous side. That's the way new modern buildings are being put up. A slab is poured on the ground and then is raised into "roof" position with hydraulic jacks. It's like lifting yourself up by your boot straps. We've described the hydraulic equipment which does this mammoth job in an article on page 60.

Circuit Planning

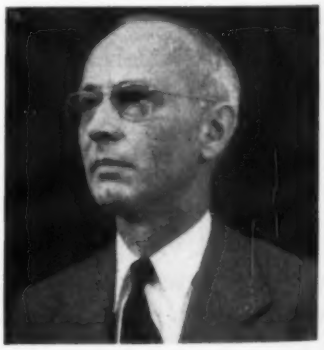
Last month we visited Scovill Manufacturing's brass mill in Waterbury, Connecticut and met again with Ben Blake and Allen Steel who handle much of the design and maintenance of the hydraulic and pneumatic equipment in the mill. They have quite a job and during the coming months APPLIED HYDRAULICS will include articles detailing some of the applications of fluid power which they have worked on.

In going through the Scovill mill and visiting the engineering department, we were immediately impressed by the careful planning which goes into every machine modification as well as new design. In many shops, when changes are made on equipment which is already in use, most of these changes go unrecorded. This is not the case at Scovill. Engineering works closely with the shop and drawings of all circuits and mechanical details are kept up to date. Such planning pays off.

Circuit drawings at Scovill even outdo the JIC standards. While the same drawing principles are used, the flow pattern in each valve is completely shown. The design engineer sketches the circuit and indicates the valve model number. A draftsman then takes the sketch and using templates prepares a drawing which shows exactly what happens in the circuit.

Most shops which maintain complete drawings have found that the cost and time taken is small in comparison to the benefits.

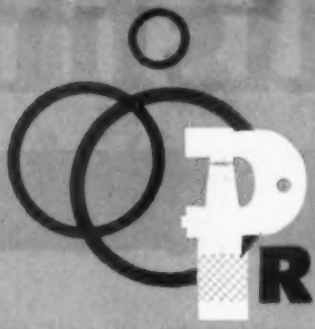
"Rule of Three"



Russ Hemeon, who is hydraulic equipment engineer at the Trenton plant of General Motors' Ternstedt Division, has written the article in this issue about "The Rule of Three". This is the selection method used by GM for bladder type hydropneumatic accumulators on *high speed* applications.

This is the first time that this procedure, which is the result of more than five years of development work, has been published. You'll get a good idea of the careful tests which were made by studying the two test graphs which Russ includes in the article. These graphs show why a selection based on Boyle's Law for an accumulator in high speed applications, is not practical.

The procedure outlined in the article results in the selection of an accumulator which is considerably larger than one selected solely on the basis of Boyle's Law.



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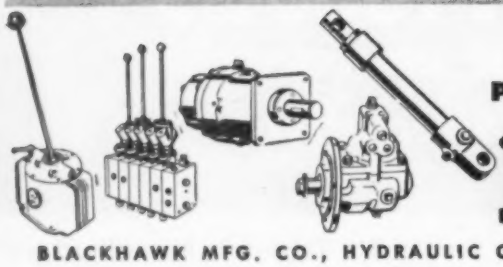
Less weight, less bulk, even more dependability — these are some of the major advantages built into this big new line of hydraulic cylinders. They fit in where bulkier cylinders can't go. Machines themselves take on extra sleekness, along with less cost and better appearance. Blackhawk cylinders are available in a complete range of sizes — in push and pull double-acting design or in the push or pull single-acting principle.

Standards or specials . . . produced by EXPANDED FACILITIES

Attractive savings are also made because of continuous quantity production of standard cylinders (and other hydraulic components). Versatile characteristics of the new cylinder design also permit economical production of specials in reasonable quantity runs. Specialized and expanded manufacturing and engineering facilities and staffs are now offered by Blackhawk's Hydraulic Control Division.



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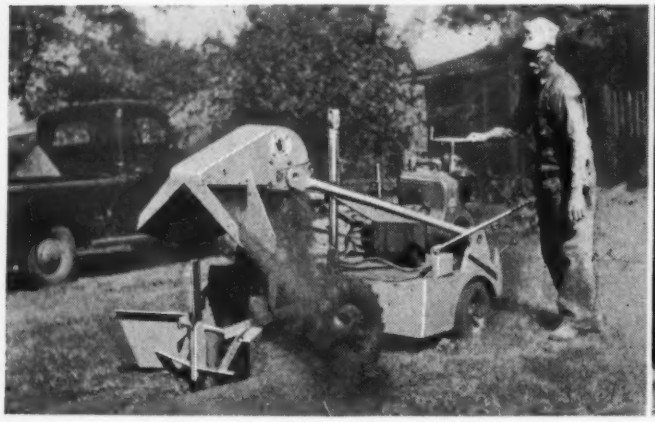
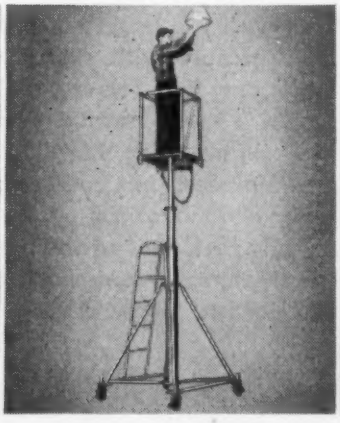
A Blackhawk Hydraulic Control expert will be glad to analyze your requirements at your convenience. Or you can write for detailed engineering literature on Blackhawk pumps, cylinders and valves for original equipment applications.



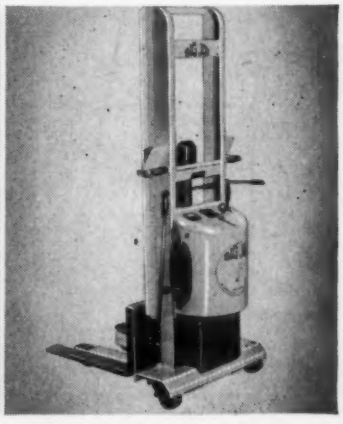
LIGHTWEIGHT TRENCHER must be heavy on performance even in rough going. That's why Blackhawk hand pump and cylinders were chosen for the hydraulic control.

ALL-HYDRAULIC LOADER has Blackhawk pump, cylinders, valves to vary truck heights, raise front wheels for highway travel, lift feeder for cleaning and servicing.

CHISEL TILLER raises and lowers wheels with Blackhawk hydraulic equipment. Position of chisels can be easily controlled for exact depth of tillage desired, or they can be raised high enough for safe road travel.



TELESCOPIC SCAFFOLD utilizes Blackhawk hydraulics to extend height from 7 to 17 ft. in just 25 seconds.



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HEAVY FOUNDATION COSTS
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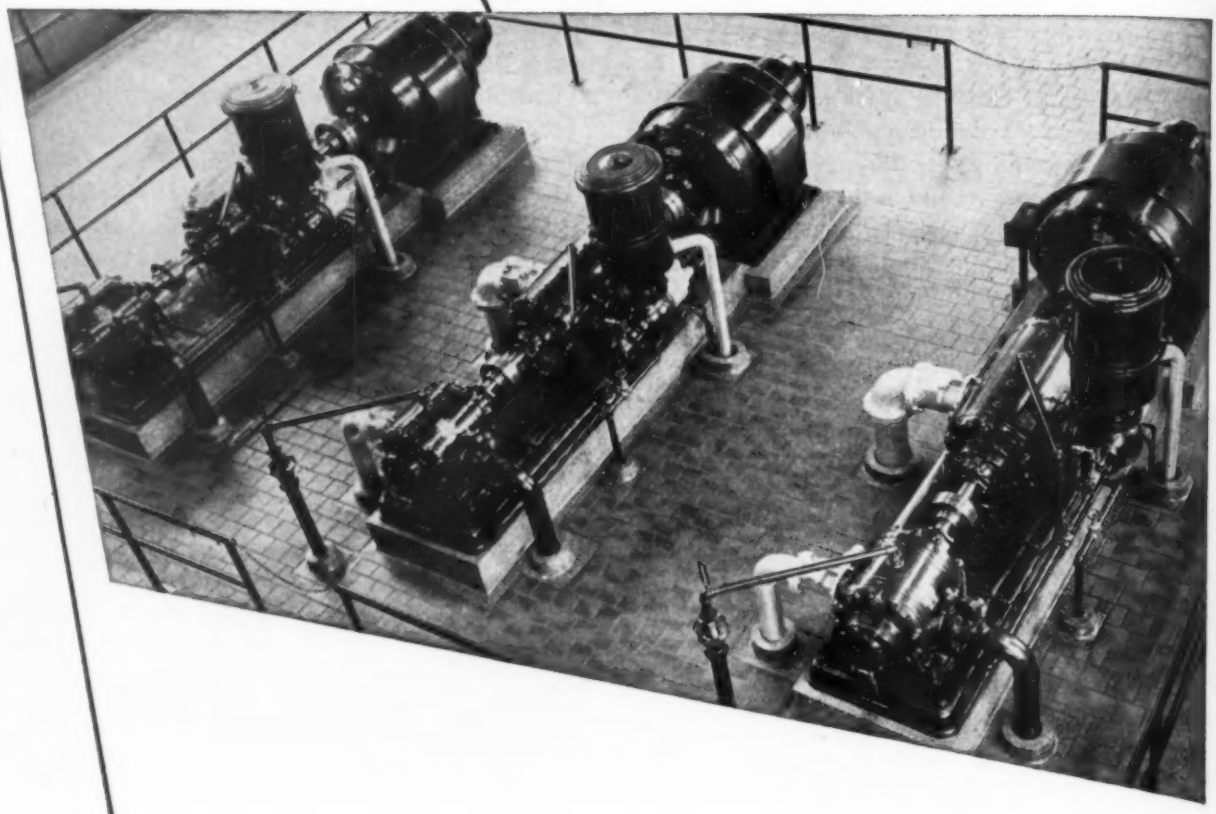

You eliminate heavy concrete foundations when you install Fuller Rotaries . . . even with the larger capacity machines . . . because with rotary there is no vibration. The battery of three Fullers shown above, having a capacity of 1085 c.f.m. each, at 100-lb. pressure, are mounted on comparatively light terrazzo foundations . . . and they're on an upper floor of the building. The installation is compact, streamlined, and efficient in operation.

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C-228

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LESSONS IN HYDRAULICS

The Beaver

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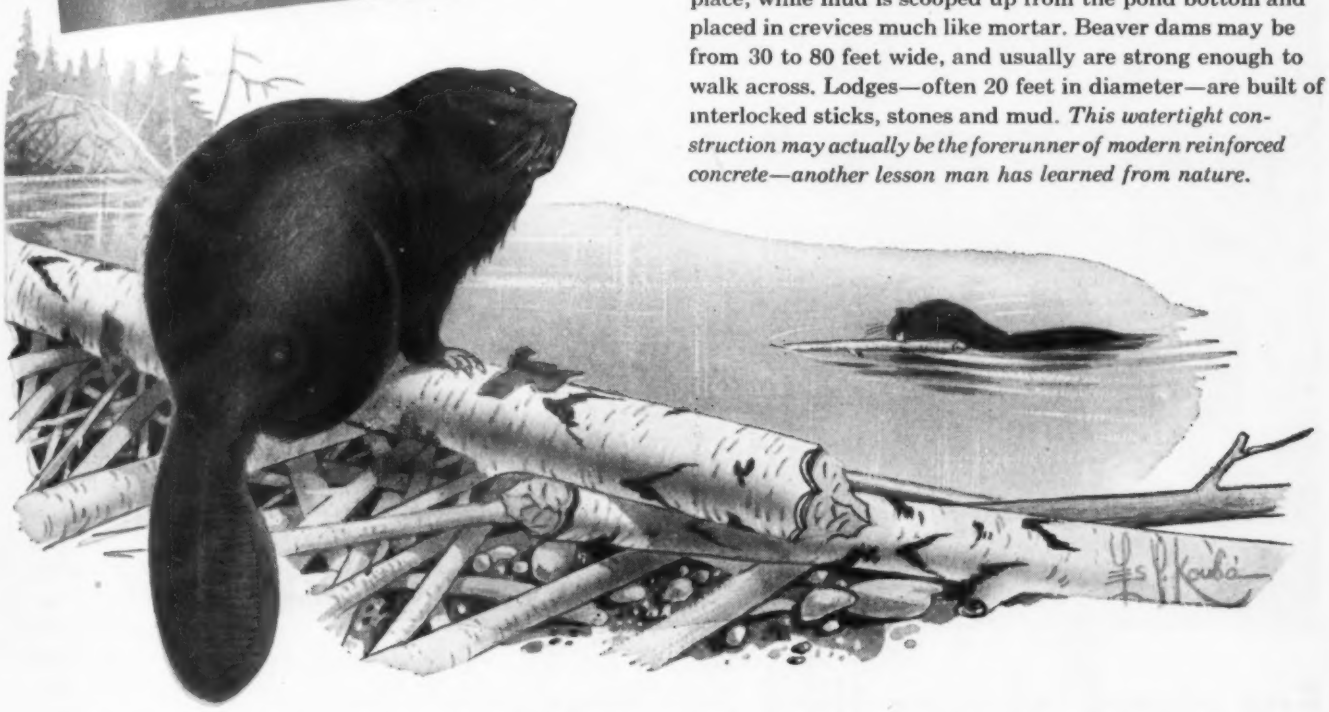

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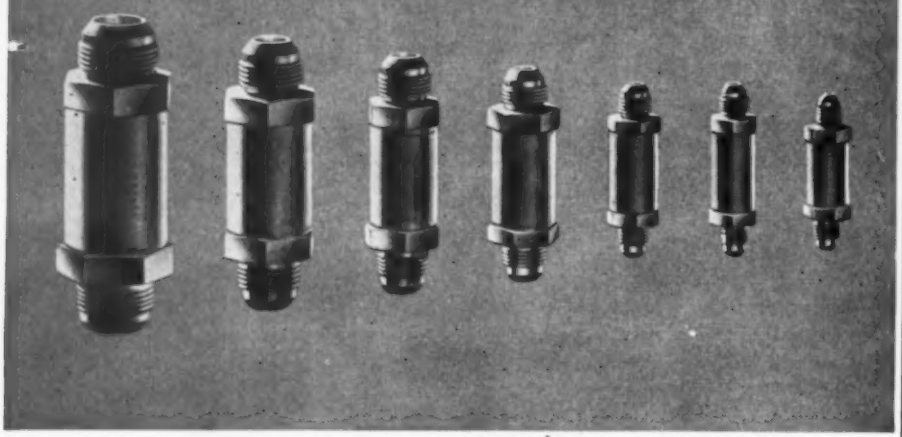

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LETTERS to the Editor

Honed Tubing

We are looking for one or more dependable sources for honed tubing for hydraulic use. We would also be interested in sources for all sizes of chevron and cup packings for both hydraulic and pneumatic cylinders.

J. S. FRANCIS
Crescent Mfg. Co.

You will find a number of dependable sources of honed tubing for hydraulic use among the manufacturers and suppliers listed in the APPLIED HYDRAULICS Directory. A copy of tear sheets of the hydraulic tubing listings from the 1953 Directory have been sent you. On the types of packings which you require, we suggest you check with one or more of the distributors of hydraulic equipment and materials in the Denver area, e.g., Ferris A. Ruggles, Engineered Products, Inc. 2810 Larimer St., Denver 5, Colo. Directory lists of manufacturers of "U" and "V" packings have also been sent to you.

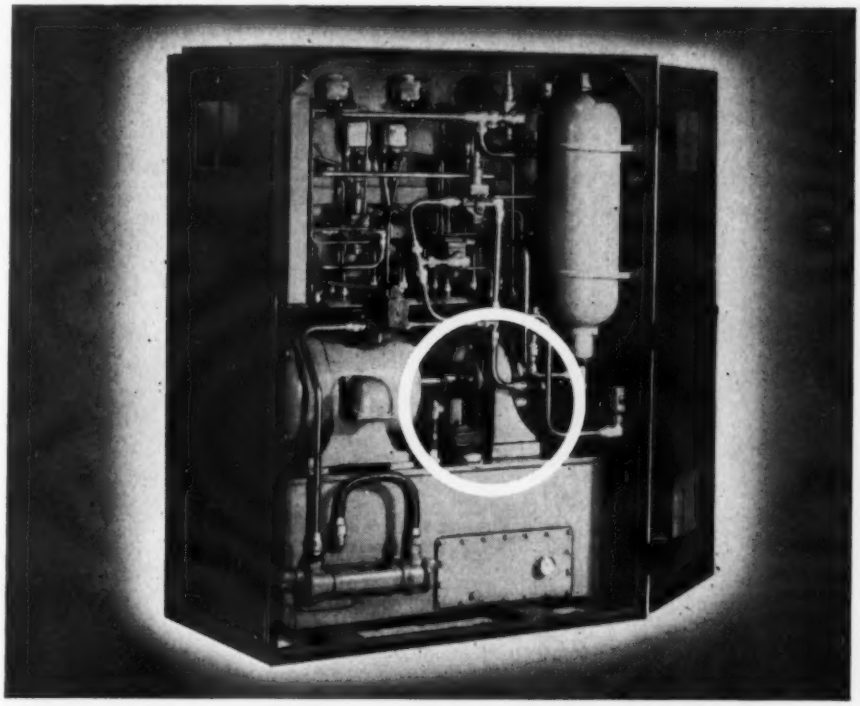
Comments on Compressor Article

I agree that Mr. Caserta has done a very good job of preparing his article ("Selection Factors for Airborne Compressors", published in two parts in the February and March, 1953 issues) and I am sure that it has been very much appreciated by the aircraft manufacturing personnel, particularly those who have recently become involved in the design of a pneumatic system or who are facing this possibility in the near future.

I would like to make the following comments which I consider quite important and which you may wish to pass on to Mr. Caserta: (1) in the first paragraph of Part 2 on page 93 of the March issue he states that jet engine lubricating oils "are usually very unsuitable for high

Continued on page 13

WHEN IT'S HIGH PRESSURE IT'S **AMERICAN!**



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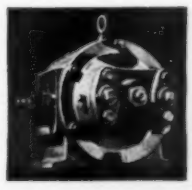

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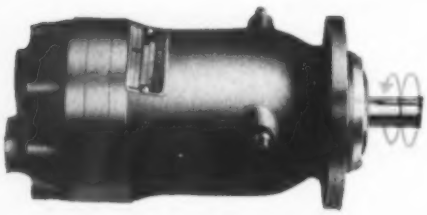
Manufactured by Stephens-Adamson Co.

Powers hydraulic "shake-down" that unloads ore cars fast



Sundstrand Fluid Motors simplify power transmission

One of the highest-quality fluid motors on the market, Sundstrand brings you all these advantages: an infinite range of speeds; eliminates old-fashioned gearing and clutching mechanism; extreme compactness; smooth, effortless power; high torque, variable control; remarkable adaptability to practically any power transmission requirement. Get new Bulletin No. 113-1 for complete specifications. Find out how Sundstrand can help improve the salability of your product!

• There are many good motor drives on the market that perform satisfactorily under normal, or ideal, operating conditions. Here's proof that Sundstrand's Fluid Motor does more than that.

On the Carquake, it drives an eccentrically weighted shaft at high speed, creating an oscillating motion that shakes tightly compacted ore out of hopper cars easily and quickly. Mounted in a rubber sleeve, the Motor is direct-connected through a flexible coupling fitted to the eccentrically weighted shaft. It feels every thumping vibration—every violent shake—as the Carquake pounds horizontally against the side sill of the heavily loaded steel cars.

Simplicity of design and precision construction of the Sundstrand Fluid Motor adapt it to these unusual conditions. Belts, chains, gears and other transmission equipment subject to wear and breakage under shock loads are eliminated. Result—design of the Carquake is greatly simplified... operation is hydraulically controlled with a minimum of time and manual effort. Perhaps your product can benefit from the application of Sundstrand mobile equipment hydraulics. Write, phone, or wire for details.

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SUNDSTRAND HYDRAULICS

SUNDSTRAND MACHINE TOOL CO.
HYDRAULIC DIVISION, ROCKFORD, ILL.

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LATHES • MILLING, BROACHING AND SPECIAL MACHINES • BROACHING TOOLS • MAGNETIC CHUCKS

Letters to the Editor

Continued

pressure compressors . . . ". Actually, the latest production jet engines, such as the Pratt-Whitney J57, uses MIL-L-7808 as a lubricant and we have been advised by the Power Plant Lab at Wright Field that this oil appears to be every bit as good as AN-O-11 for the lubrication of high pressure compressors. I feel that we should not attempt to discourage the use of jet engine oil for the lubrication of engine driven compressors, assuming the oil is satisfactory; (2) in the fourth paragraph of column 2 on page 94 of the March issue, he suggests the line between the compressor and the reservoir should serve as an aftercooler —"In most installations the line between the outlet of the compressor and the reservoir acts sufficiently as an aftercooler to prevent objectionably high temperatures at the reservoir". Actually, the line connecting the compressor to the reservoir or the moisture separator, whichever the case may be, should be as short as possible and preferably be insulated. The purpose of keeping this line warm is to prevent moisture from condensing out of the air before it reaches the reservoir or moisture separator. This is particularly true if there are any moisture traps in the line, which is quite often the case. From an installation standpoint, this is one of the most important considerations for a satisfactory pneumatic system. I would definitely recommend that the line between the compressor and the reservoir be not considered as an aftercooler. I would go further and suggest that the line between the compressor and the first reservoir or moisture separator be insulated and that, if at all possible, moisture traps should be eliminated.

ROBERT S. THOMPSON
Sales Manager
The Cornelius Company

Bob Thompson's comments on engine driven compressor lubrication states in fact that, in some cases, a satisfactory lubricant may be available at the mounting flange. Of course, if this lubricant is of satisfactory type, in acceptable

Continued on page 16

Pack more performance into your hydraulic systems

for **PUMPS, VALVES, PRESSES, CYLINDERS...**

"John Crane" Chemlon "C-V" Rings continue to solve problem after problem in the field of hydraulic operations. Design and application is no longer hampered by the low temperature, non-corrosive limitations of conventional O and V ring packings. "John Crane" Chemlon "C-V" Rings are molded from Teflon to provide complete inertness to all hydraulic fluids, oils, and all petroleum products. They can be used through a wide temperature range from —94° to +482°F. Friction coefficient is extremely low. "Breakout" friction is only slightly higher than that of running friction.

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JOHN CRANE CRANE PACKING COMPANY

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U. S. Matchless Steam Hose installed on hydraulic record press.

Battery of presses in the record factory. Note high flexibility of the hose.

Carrying steam at 350°F, 120 pounds pressure, and flexing 6 times a minute—that's the record-breaking job U. S. Matchless® Hose does in making phonograph records for an Eastern factory. Installed on hydraulic presses, Matchless has been on the job *for over two years* so far, with *no* failures. No ordinary hose could stand up under this treatment or protect the worker from dangerous steam. This United States Rubber Company hose really pays off in durability and safety.

Naturally, like every "U. S." product, Matchless Hose is the result of careful study and manufacturing control on the part of "U. S." engineers. For any industrial problem, call on these engineers at any of our 25 District Sales Offices. Or write to address below.

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ENGINEERS AND BUILDERS OF OIL-HYDRAULIC EQUIPMENT SINCE 1921

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For lubricating, hydraulic, transfer, circulating, burning oils service. Built in 5 sizes.

The Tuthill Model L is the pump that introduced the first practical mechanical seal for leak-free performance and low power consumption. This compact, efficient positive displacement internal-gear rotary pump is offered in the following types to fit the pump to the need—in capacities from ⅓ to 6 g.p.m. and pressures to 600 p.s.i.

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For burning oils service. Flanged ports, 3-bolt mounting. Built in 3 sizes. Available also with built-in ball bearings as Model LDK.

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For lubricating service. Flange mounting without shaft seal. Choice of internal or external porting. 3 sizes.

MODEL LH
For hydraulic service. Pressures to 600 p.s.i. 4 sizes.

MODEL LK
For lubricating, hydraulic, transfer and circulating service. Built-in ball bearings. 4 sizes.

MODEL LPV
For lubricating, transfer and circulating service. Built-in adjustable by-pass valve. 3 sizes.

MODEL LSA
Stripped pump for built-in applications in lubricating, hydraulic, transfer and circulating service. Includes Model L cover, idler gear and rotor. 5 sizes.

MODEL RL
Automatic reversing feature permits driving pump in either direction without changing direction of flow or changing port positions. For lubricating and hydraulic service. 3 sizes.

Write for Catalog No. 101 on Model L pumps. Also ask for Tuthill Pump Guide on complete line of Tuthill pumps.

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Ingersoll, Ontario, Canada

Letters to the Editor

Continued

quantity, under acceptable pressure, at acceptable temperature and if the engine manufacturer does not object to the circulation of this oil through the compressor and if all other conditions make the use of the engine oil preferable to the use of a separate reserve in the compressor, it is not seen how anyone could object to the use of engine oil.

Similarly, there cannot be any disagreement as to his comment on outlet air temperatures. The statement as to the ease with which usually objectionably high outlet air temperatures can be avoided, was meant (as was the whole article) mainly for the beginners in pneumatics, who usually inquire as to high outlet temperatures. The writer should have connected the objections to high outlet temperatures to the damage that may be done to flexible hose, check valve elements and other not completely metallic units which may be between the compressor and the reservoir, rather than to the reservoir.

M. CASERTA
Manager,
M. C. Manufacturing Co.

Hydraulics Goes to College

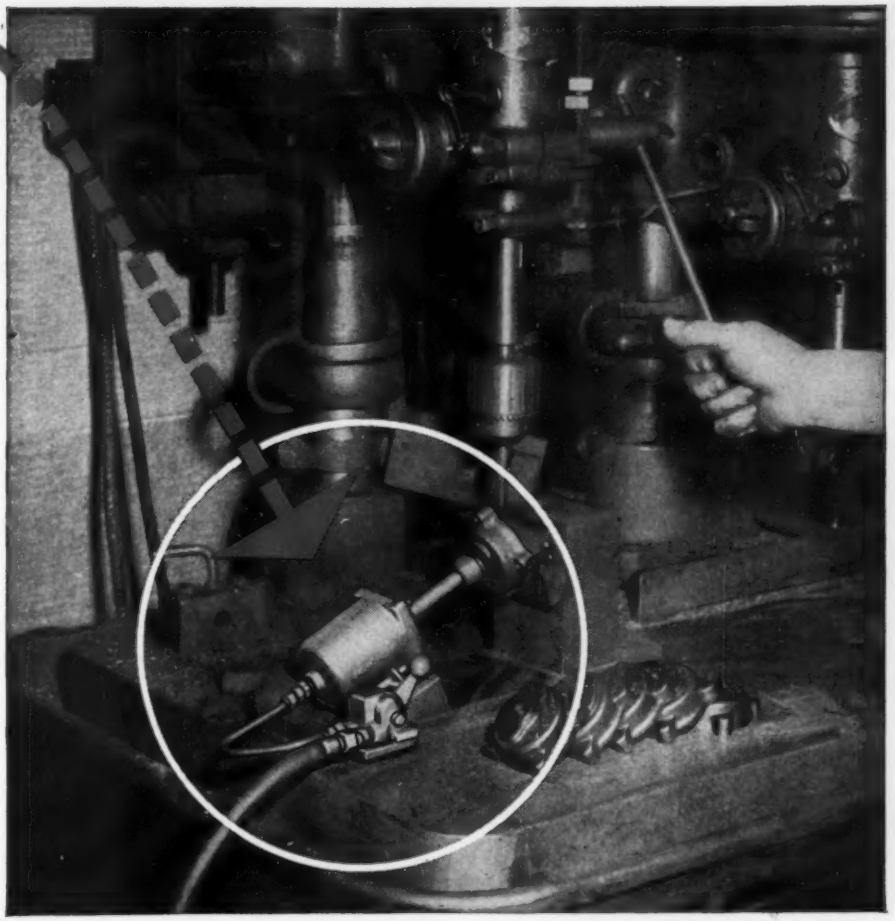
We have recently instituted a four year curricula in Tool Engineering. I have been assigned to teach Hydraulics and Pneumatics to students after they have completed a standard course in Fluid Mechanics. Would you be kind enough to furnish me whatever literature you have available on Hydraulic and Pneumatic Equipment including transmissions, circuits and applications. I have been unable to find a suitable textbook; any help you can provide will be much appreciated.

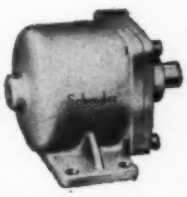
MELVIN J. GREAVES
Associate Professor,
Utah State Agricultural College,
School of Engineering and Technology

(*Editor's note: This letter was actually written to American Engineering Company, who forwarded a copy to us so that Professor*

Continued on page 18

Simplify any work-holding problem





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Schrader ClampAir Cylinders are available either base or leg mounted, in 1", 2¼" and 3" diameters delivering a 2" or 1" stroke. A wide selection of Schrader Valves is available, too, to operate ClampAirs.

Watch a worker making ready for a simple drilling operation. He places the work in a fixture and hand-clamps it. With everything all set to go, you'll find he takes as much as ten seconds just to grip the work tightly in the clamp.

Multiply that by thousands of machine operations. You'll find a substantial portion of work time is used up *before* actual production begins.

You can eliminate nearly all of this lost time with the new Schrader ClampAir Cylinder... with no more effort than opening a valve.

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It's easy to find out how ClampAir can increase production and worker efficiency. Write, outlining the applications in which you are interested—or fill out the coupon below.

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Precision-built and texture-engineered for practically all services, Darcova Pumcups outlast most other packings at least 3 to 1. Fluid slippage is virtually eliminated, assuring *continuous* high efficiency. Far less maintenance! Lower operating costs! Send today for a free bulletin packed with helpful data and proof.

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THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 15, PA.

PUMCUPS

Letters to the Editor

Continued

Greaves might get a more complete answer to his problem).

Material on hydraulics and pneumatics that could be used for technical school training is very scanty and difficult to find. We are sending a copy of the APPLIED HYDRAULICS Data List, a short, practical bibliography which might serve as a starting point. We believe the best information is still contained in the catalogs, bulletins and technical data sheets of active manufacturers in the field. Elsewhere we have recommended in this column two manuals that are the nearest to a text of any material we know. Actually, we believe that this is a project for joint action of the Hydraulic Division, ASME and the American Society for Engineering Education. Arthur Bronwell, Professor of Electrical Engineering, Northwestern University, Evanston, Ill., is secretary of ASEE.

"Geronimo"

Can you furnish me with any suggestions as to a method of estimating the size of parachute needed for a given size load to descend at a given rate? Is there an elementary text on the subject?

F. E. O'NEILL,
Johnston Testers, Inc.
Los Angeles, Calif.

We didn't know so we got the opinion of a specialist. The answer of H. K. Epple, Project Engineer, Irving Air Chute Co., Inc., Buffalo, N. Y. follows:

The basic equation to determine the size of a parachute for a given load and with a certain rate of descent is

$$W = \frac{C_D \times S \times g \times V^2}{2}$$

Where

W = *weight of load in pounds*

S = *drag area of parachute*
$S = \frac{\pi \times D^2}{4}$

D = *diameter of parachute in feet*

ρ = *density of air in that altitude where a certain rate of descent must be obtained*

Continued on page 21

Circle 27 on Reader Service Card

Circle 55 on Reader Service Card

F

For Efficient Power Transmission

The "CARLISLE" GRADER
KEELAVITE HYDRAULICS GIVE EFFICIENT TROUBLE-FREE CONTROL
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Letters to the Editor

Continued

$= .00238 \text{ lbs.} \times \text{sec}^2 \text{ for sea level}$

ft^4

C_D = coefficient of drag for the parachute

$= .58$ for solid flat parachute

$= .53$ for ribbon parachute

$= .49$ for guide surface parachute

The reason for giving various values for the coefficient of drag is the fact that for the various applications, different types of parachutes will be used. If the velocity at which the parachute will be released is approximately 200 mph, a solid flat parachute will be used. If the velocity goes up to approximately 350 mph and the opening shock should not exceed a certain amount, a ribbon chute should be used. For higher velocities, the use of a guide surface parachute is unavoidable. It may be pointed out, however, that guide surface chutes are built at present only to a diameter not exceeding 10 feet. In dropping heavy cargoes a multiple stage recovery system is used, whereby a guide surface chute will decelerate the load in the first stage to a more reasonable velocity, so that for the second stage a solid flat canopy can be used. To figure out exactly what type of parachute or how many stages should be used to recover a load, the design and selection in each case should be done only by an experienced parachute designer.

To illustrate the use of the above equation, we might use the following example. By transferring this equation to

$$S = \frac{2W}{C_D \times g \times V^2} = \frac{\pi \times D^2}{4}$$

the diameter of the parachute will be obtained as

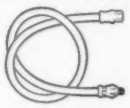
$$D = \sqrt{\frac{8 \times W}{C_D \times g \times V^2 \times \pi}}$$

Assuming that a load of 200 pounds shall be lowered with a rate of descent of 20 ft/sec at sea level, a parachute with a diameter

$$D = \sqrt{\frac{8 \times 200}{.58 \times .00238 \times 20^2 \times \pi}}$$

$=$ 30.5 feet for a solid flat canopy will be necessary.

Supplied in Assemblies



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Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

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And just as important, the Flex-O-Tube organization is one that you can rely on, too. When the pressure's on for production you can count on prompt deliveries of flexible hose products that consistently meet specifications.

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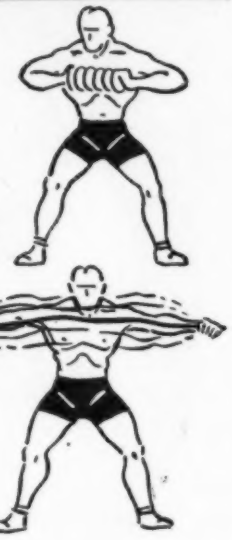

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Republic WIRETEX is NEW — a truly modern conductor internally reinforced with high tensile wire. It's easy to handle, unbelievably tough and long lasting. What's more, Republic WIRETEX is built in 60-foot **Economy Lengths.** You save money when you buy Republic WIRETEX; time and money when you use it! Get the facts today! Republic WIRETEX Hose is available in all standard (⅜" to 2" inclusive) sizes.

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INDUSTRIAL RUBBER PRODUCTS

Letters to the Editor

Continued

New JIC Hydraulic Standards

Please advise how a copy of the JIC Hydraulic Standards for Industrial Equipment, discussed on page 104 of your March 1953 issue, might be obtained.

AUSTIN U. BRYANT,
Chief Engineer,
Grove Regulator Co.

Copies of the JIC Hydraulic Standards for Industrial Equipment are available from Joint Industry Conference, Box 182, North End Station, Detroit 2, Mich. We understand that the revised Standards, to include changes agreed upon at the January meeting, will shortly be available.

All Pneumatic Automatic Circuits

We would like to know the names of manufacturers or of their representatives in our territory who could supply equipment or information on automatic cycling systems operated 100 percent by air. We are working on a system for a plant where electrical circuits are not permitted.

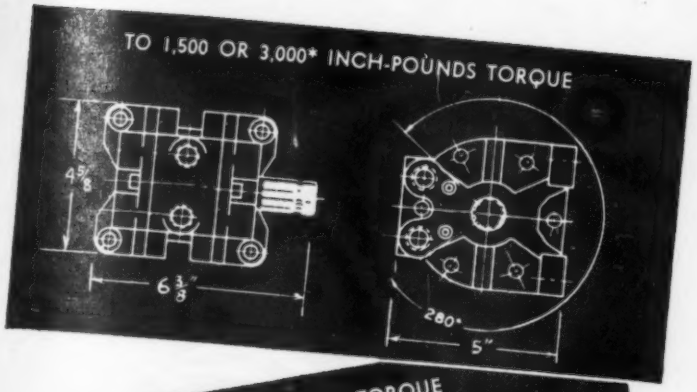
GEORGE FEELEY,
President,
Industrol Corporation

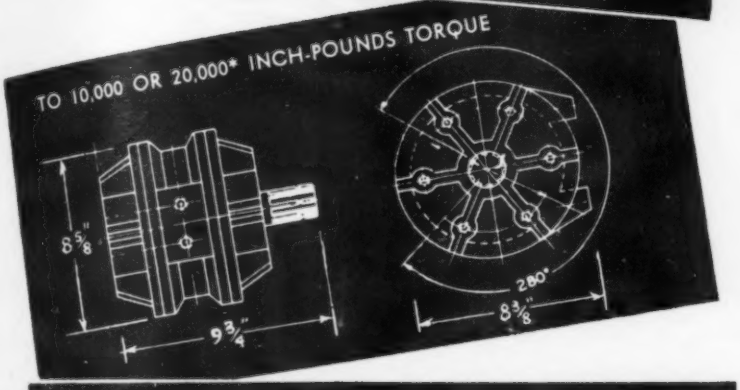
There are several manufacturers that offer equipment that gives you 100 percent pneumatic operation. Perhaps, in your case, it would be best to get in touch with one or two of the outstanding dealers or distributors of such equipment in your vicinity. As a starter, we suggest Compressed Air Products, 1977 Springfield Ave., Maplewood, N. J. or the George M. Pearse Co., 1060 Broad St., Newark, N. J.

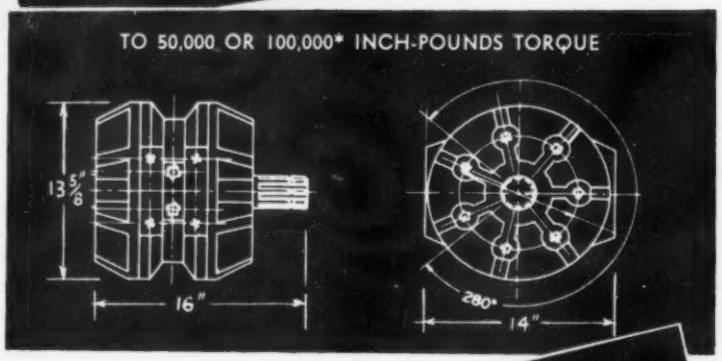
Entering Our Field

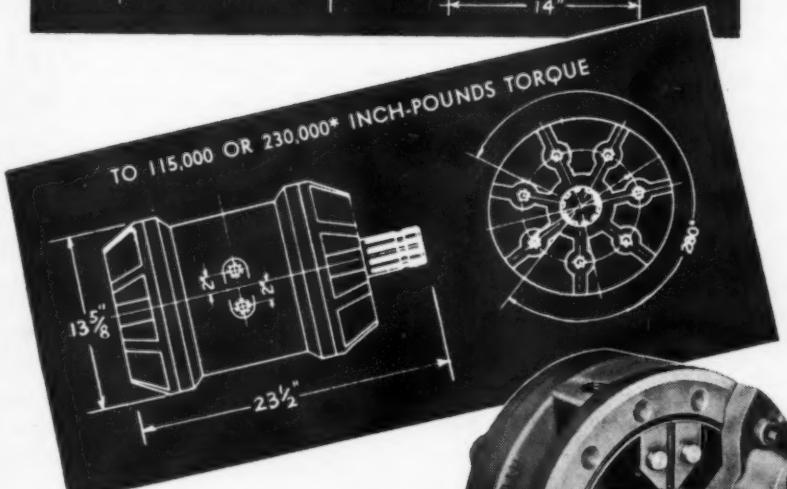
I am a senior mechanical engineering student at Clarkson College of Technology. In June I am going to be employed at the New York Air Brake Company, in the Hydraulic Division. To aid my study of high pressure hydraulics, I would like to have a copy of the 1953

Continued on page 25









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RECIPROCATING ROTARY POWER

SMOOTH-OPERATING, EFFICIENT, COMPACT, LIGHT-WEIGHT, CLEAN AND TROUBLE-FREE

Operating with either oil or air, the Bonnot Hydromotor provides reciprocating rotary power . . . develops instant, full torque in either direction through any arc up to 280° . . . may be stopped at any point, reversed, speeded up or slowed down by simple controls.

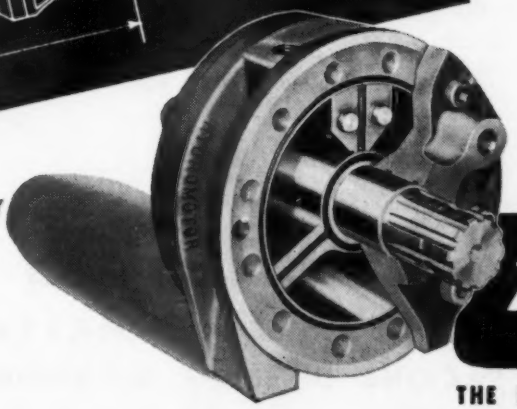
Compact and light-weight, the Hydromotor replaces heavy, bulky, troublesome pistons and cylinders and complicated linkages . . . performing the same jobs smoothly — positively — more efficiently.

It is completely sealed against dirt and leakage . . . may be installed anywhere . . . at any angle. Simple, rugged, trouble-free, requires practically no attention.

Two-vane models, same size, develop double torque values through any arc up to 100°—all based on 1,000 p.s.i.—oil supply.

For complete application and engineering data write for Hydromotor Bulletin 21.

Name of Local Agent on Request



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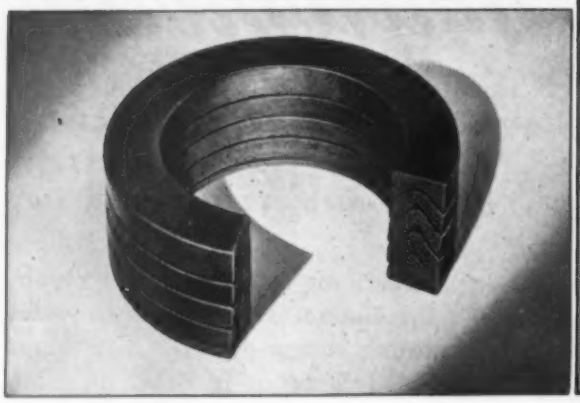
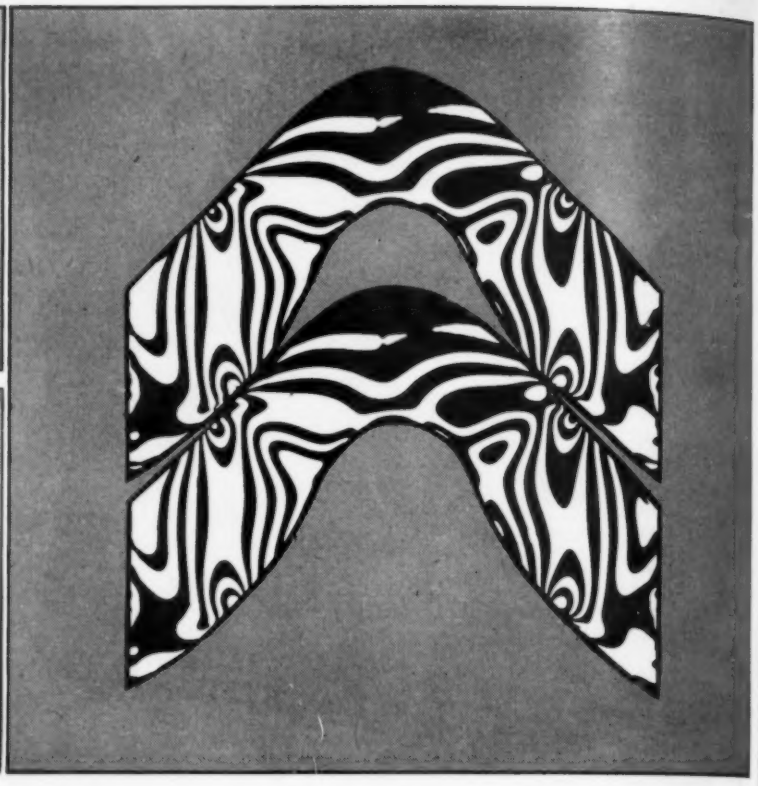
PHOTOELASTIC STRESS ANALYSIS OF VEE-FLEX® PACKING RING





Here's how R/M Vee-Flex Packing Rings automatically seal against pressure

R/M Vee-Flex Rings are widely used for packing pumps, valves, rams, presses, hydraulic cylinders, and other equipment. They are self-sealing and self-adjusting. Hydraulic pressure automatically expands the lip or circumference of the ring on the pressure stroke, forming a tight seal against stuffing-box wall and shaft. On the return stroke, the ring resumes normal position.

Shown above is one of a series of photoelastic stress analyses* made with the R/M Vee-Flex design.

Because Vee-Flex Rings have a convexly curved surface where they contact adjacent rings, a flexing action results which automatically produces a seal. Fringes in the photoelastic stress patterns show that the R/M Vee-Flex design distributes pressure laterally against the stuffing box wall and shaft, as well as longitudinally against the next ring.

Photoelastic analyses were corroborated by radial pressure tests* in which maximum sealing performance occurred at a point slightly below mid-width on the sealing area.

R/M Vee-Flex Rings provide a perfect seal, even when pumps or hydraulic cylinders are not in motion.

They nest together in sets, and the design brings full automatic expanding action to each of the nested rings. By increasing gland pressure, R/M Vee-Flex Rings continue to provide a reliable seal, even after wear has eliminated the automatic feature.

Vee-Flex Rings are made for practically all hydraulic and fluid-handling equipment up to 60" diameter. They are available in endless and split type rings.

Five types provide sealing against pressures up to and beyond 6000 psi for service against air, water, oil, steam, hydraulic, and other commercial fluids.

Write for R/M Vee-Flex Bulletin

**Performed at The Franklin Institute Laboratories for Research and Development.*

R/M

PACKINGS

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Crawfordsville, Ind.; Passaic, N.J.; Neenah, Wis.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Teflon Products • Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

Letters to the Editor

Continued

Directory issue of APPLIED HYDRAULICS. I would appreciate suggestions of other major sources of information on hydraulics.

F. O. BLACKWELL, III,
Potsdam, N. Y.

We are sending you a copy of the 1953 Directory issue of APPLIED HYDRAULICS as requested. We are also sending a copy of the APPLIED HYDRAULICS Data List, which is a bibliography of the leading manuals, technical bulletins and catalogs available in the hydraulic and pneumatic industries. Good luck to you as you enter this fine company in our progressive industry.

SAE Handbook

In your article "Application and Design of Compression Type Fittings", Part 7, in your February, 1953 issue, you mention the latest issue of the SAE Handbook. Please advise where we can secure a copy of this handbook.

A. H. DEROCHER
Arthur H. De Rocher Co., Ltd.
Honolulu, Hawaii

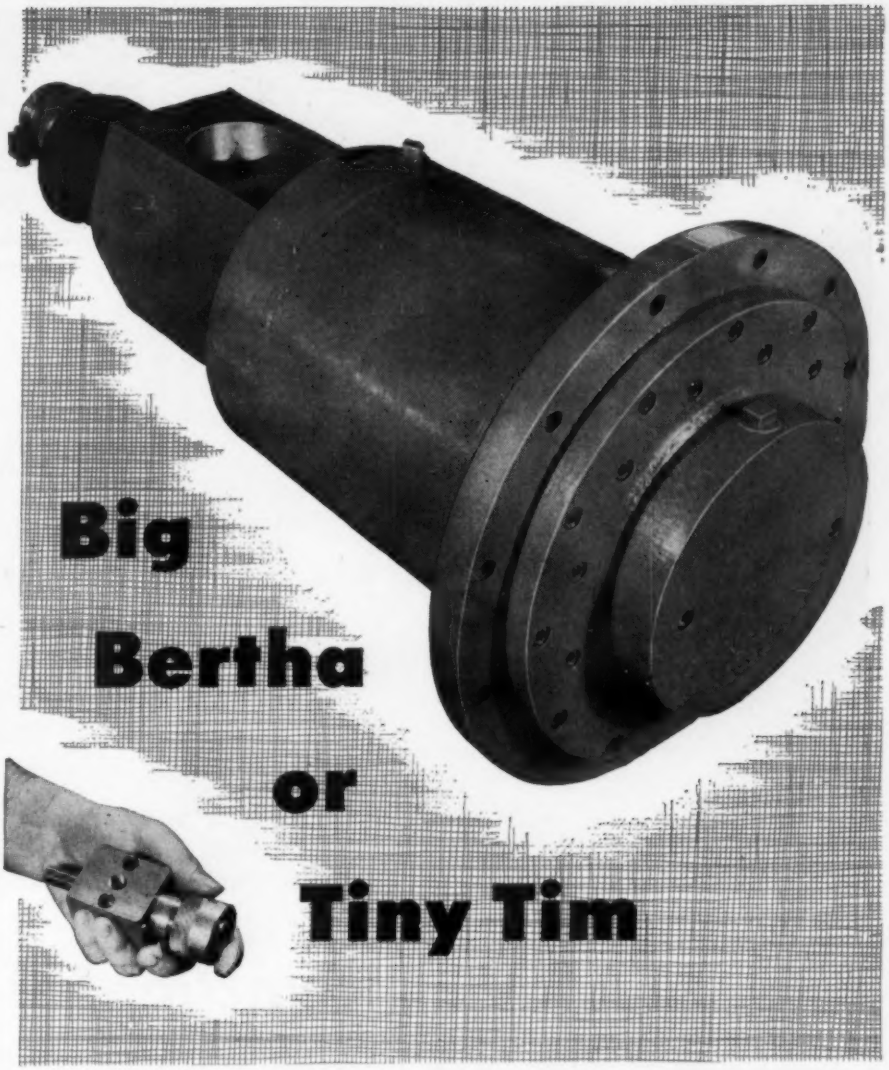
Copies of the latest issue of the SAE Handbook may be secured from the Society of Automotive Engineers, National Headquarters, 29 West 39th Street, New York 18, N.Y.

Fluid Motors and Pumps

We are attempting to locate an article of fluid motors and fluid pumps which appeared in a 1952 fall issue of your magazine. Is this information sufficient to identify the article?

R. SMILJANIC,
Kiekhaefer Corporation

Yes, we can identify the article. We believe you have reference to "Design of a 2000 PSI Vane Hydraulic Pump-Motor" by J. R. English of the Denison Company, which was published in the December, 1952 issue of APPLIED HYDRAULICS. We are sending you a set of tear sheets of this article.

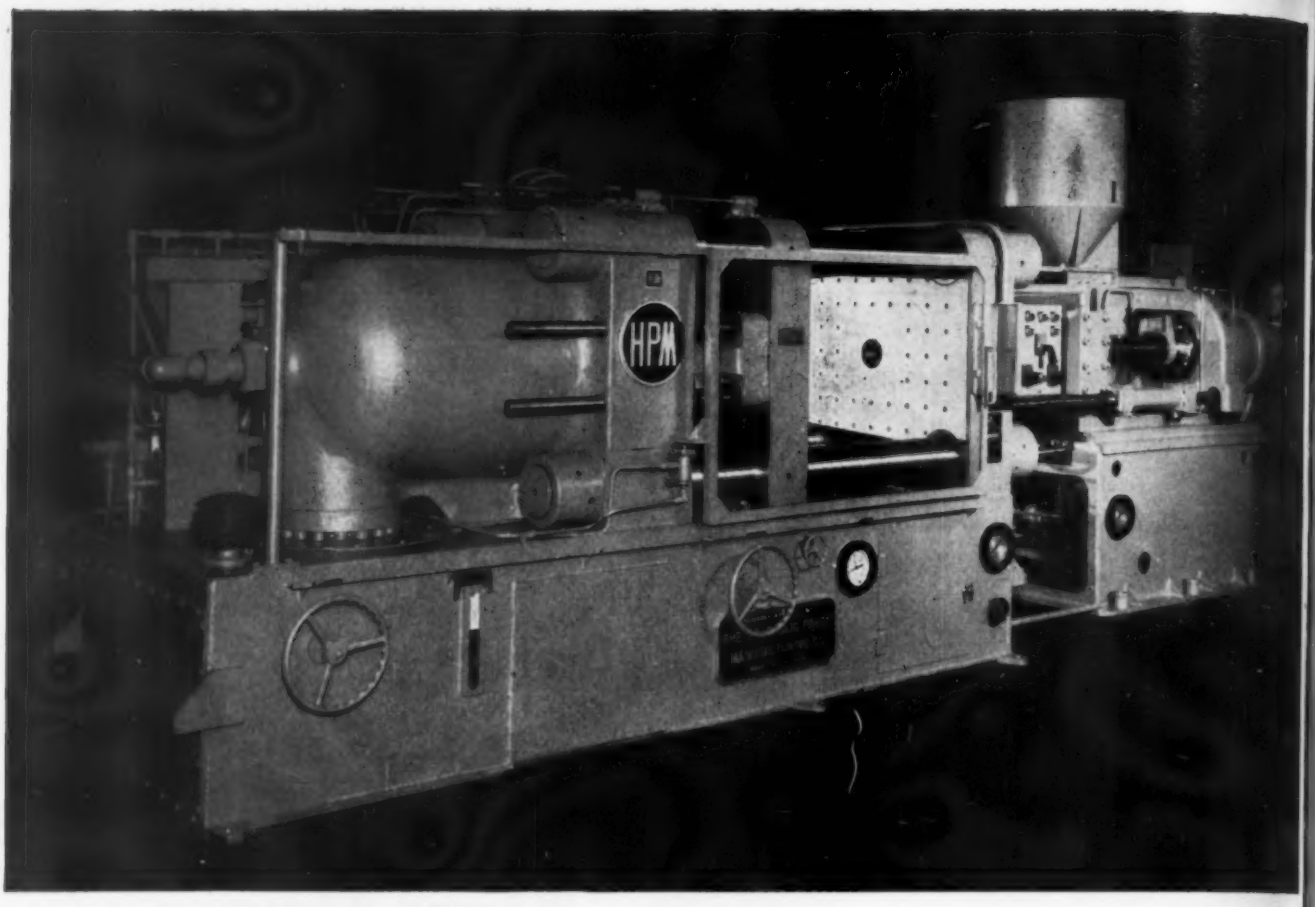


Your Anker-Holth cylinder matches your job

● Sure, the above cylinders are unusual. The big one has an 18-inch bore and 19-inch stroke, and handles 2000 p.s.i. hydraulic pressure! The little one has a 1-inch bore and is for air power. But both are all in a day's experience of the nearby Anker-Holth engineer who is available to help you solve problems in power motion. To be sure you get the *right* air or hydraulic cylinder for *your* specific job, *specify* Anker-Holth and ask for our engineering help. Call or write Anker-Holth Division of The Wellman Engineering Company, Dept. C-4, 2723 Conner St., Port Huron, Michigan.

FREE *on request . . . bulletin on complete line of Anker-Holth products.*

Anker-Holth
ENGINEERED CYLINDER POWER
WELLMAN
Division of THE WELLMAN ENGINEERING COMPANY



H-P-M 32 oz. capacity All-Hydraulic Plastics Injection Molding Machine manufactured by the Hydraulic Press Manufacturing Company, Mount Gilead, Ohio

MARVEL *Synclinal* FILTERS

. . . used by The Hydraulic Press Manufacturing Co. in their plastics injection molding machines and die casting machines.

Just a glance at the Plastics Injection Molding Machine shows it has been built to stand rugged wear. Naturally a machine of such vital use in the plastics industry was planned by the manufacturer to give long years of service. And just as naturally, the manufacturer included in these plans the durable protection of MARVEL Synclinal FILTERS, for its hydraulic system.

MARVEL Synclinal FILTERS have proved their superiority where dependable protection is a prime consideration. They meet all requirements that call for heavy duty and still maintain peak performance.

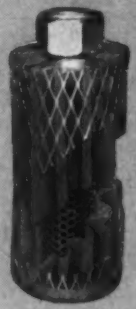
MARVEL SYNCLINAL DESIGN MEANS LESS FLOW RESTRICTION—PEAK PERFORMANCE

LINE TYPE (Cutaway)

You get maximum active filtering area in a minimum of space because of the unique Synclinal design. This is the reason why OVER 350 ORIGINAL EQUIPMENT MANUFACTURERS specify and buy MARVEL Synclinal FILTERS. Filter maintenance "down-time" is reduced to an absolute minimum because MARVEL Synclinal FILTERS may be disassembled, cleaned and reassembled in a matter of minutes.

MARVEL FILTERS are available in sump and line type models, in capacities from 5 to 100 g.p.m. and in monel mesh sizes from 30 to 200. Line types operate in any position and may be serviced without disturbing pipe connections. Marvel Engineers are always available to give the facts and help solve your filtration problems.

WATER FILTERS—Both our sump and line type models are now designed for use in all water filtering applications.



SUMP TYPE (Cutaway)

Write for Complete Engineering Data —Specify Oil or Water

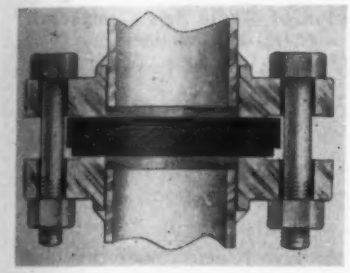
MARVEL *Engineering Company*

Meets J.I.C. Standards

625-F3 W. JACKSON BOULEVARD, CHICAGO 6, ILL.

NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.



METAL ALIGNING GASKETS . . . for flange sealing applications

Designation: Vic-O-Seal

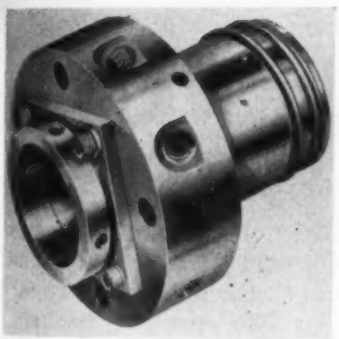
Design: Positive seal on misalignment up to 6 degrees. Avoids costly welding fixtures and can be used with all standard fittings. Available with O-ring seal or metal to metal fit.

Features: Prevent leakage due to misalignment. Economical, efficient and effective method of joining flanges.

Application: Can be used for all fluids, gases and air. Time tested at over 7000 psi.

Vickers Incorporated
Division of Sperry Corporation
El Segundo, California

Circle 215 on Reader Service Card



STUFFING BOX SEALS . . . ready for installation

Designation: Model SB seals

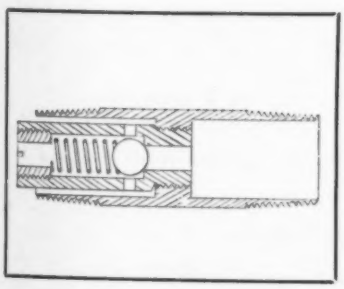
Design: Engineered for the particular job requirements with special emphasis on ruggedness and durability. Special hard facings are available for maximum wear resistance at the point of sealing. Careful control of hydraulic balance maintains minimum face loads to ensure long life.

Features: Completely preassembled packaged units. Seal faces are fully protected against damage or contamination in storage or while being handled.

Application: For use in centrifugal pumps.

Sealol Corporation
Providence, Rhode Island

Circle 216 on Reader Service Card



RELIEF VALVE . . . for 1200 psi service

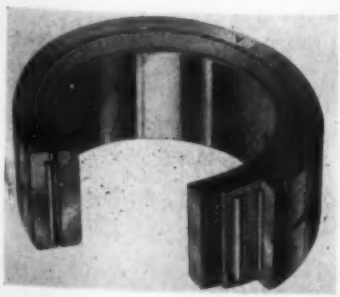
Design: Has ¾ inch male pipe threads on both ends and has external dimensions the same as a ¾ inch nipple 3 inches long.

Capacity: 10 gpm and is normally furnished set at 1000 psi. It can be adjusted down to 800 psi or up to 1200 psi and can be furnished set within the above limits.

Application: To protect hydraulic systems against excessive pressures.

Simonsen Manufacturing Company
Quimby, Iowa

Circle 217 on Reader Service Card



ROLLER BEARINGS . . . for limited space

Designation: Pitchlign bearing

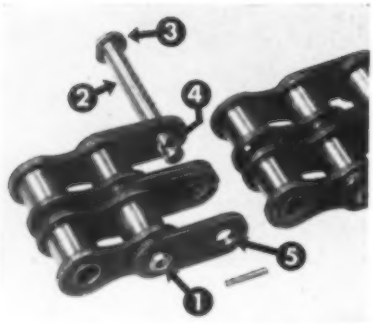
Design: It employs a cage which guides the rollers along the whole length of their pitch line. The aligning cage in turn is rigidly supported by the two shoulders of the race on which it rides. These features provide double alignment. The rolling elements are always in proper relationship with the raceway. One continuous raceway from end to end assures uniform size throughout.

Sizes: For shaft diameters from 5/8-9¼ inches.

Roller Bearing Company of America
Trenton, New Jersey

Circle 218 on Reader Service Card

Continued



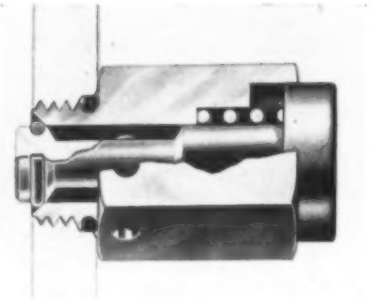
ROLLER CHAIN
. . . improved, easier to assemble

Design: Has single pin, easily removed, disconnects the chain and center links and spacer plates cannot move or fall out when disconnecting chain. One end of the single pin coupler link is firmly riveted to the adjacent link. The other end contains the single pin coupler pin.

Features: The chain is supplied in ASA standard and heavy series, 1 through 2½ inch pitch sizes in multiple width. It is made up in ten foot lengths, and any even pitch length of chain from 2 pitches up to ten feet can be made from one box of chain.

Baldwin-Duckworth Division of Chain Belt Company
Milwaukee, Wisconsin

Circle 219 on Reader Service Card



RELEASE VALVE
. . . bleeds air from oil system

Size: Overall external length of the standard valve is less than 1 inch with a 13/16 inch hex.
Design: Four working parts, the design assures dead-tight sealing and long trouble-free operation. The valve is normally held closed by a spring when the manual pressure is released. It is to provide quick operation, at the same time eliminating the hazards involved where pet-cock types of valves would normally be employed and possibly not turned off.
Features: To allow rapid escape of air pressure systems, bleeding of air out of fluid systems.

James-Pond-Clark
Pasadena, California

Circle 220 on Reader Service Card

PRESSURE SWITCH
. . . . in explosion-resisting enclosure

Features: Two distinct types of this control are available to meet varying requirements. The water pump switch has a 20 to 80 psi pressure range. The air compressor switch has 40 to 200 psi pressure range. Air compressor switch is available with a two way release valve. Control is easily adjustable over its entire pressure range.

Construction: Consists of a two piece casting with highly machined surfaces between cover and case. The operating mechanism is of the positive snap-action type, insuring positive contact regardless of range or differential spring adjustments. The

Square D Company
Milwaukee, Wisconsin

Circle 221 on Reader Service Card

HYDRAULIC SERVOVALVE
. . . has twin piston design

Designation: Model 4
Design: Has symmetrical twin piston, valve will operate smoothly under adverse vibration and lateral acceleration conditions. The valve has no external leakage. Both pistons are readily accessible for mechanical actuation and may be utilized for safety limit stops.

Specifications: Working pressure 200 to 3000 psi; power to load (max.) approx. 5 hp; steady state leakage 0.1 to 0.2 gpm (adjustable); weight 2.8 lbs; torque motor balance current 20 ma; torque motor continuous current (max.) 40 ma.

Midwestern Geophysical Laboratory
Tulsa, Oklahoma

Circle 222 on Reader Service Card

For more New Product Information turn to page 102

Circle 61 on Reader Service Card

BIG CYLINDERS

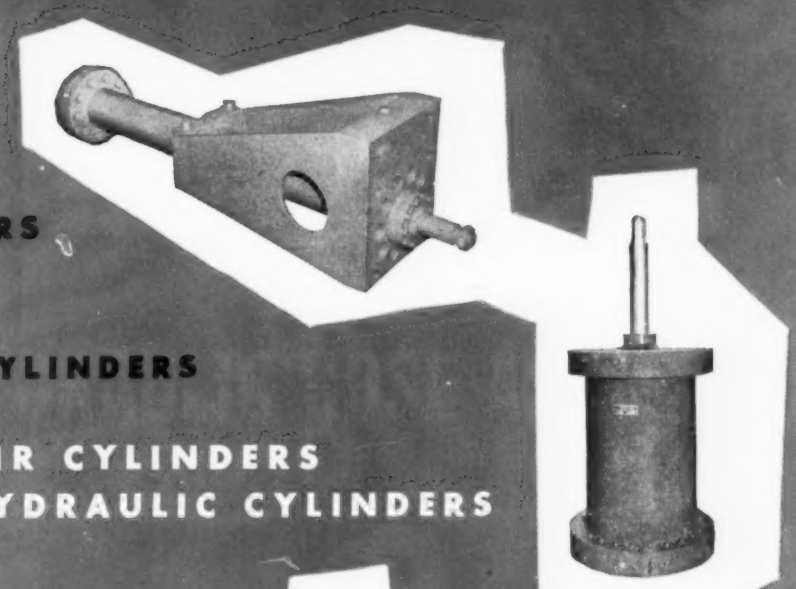
LITTLE CYLINDERS

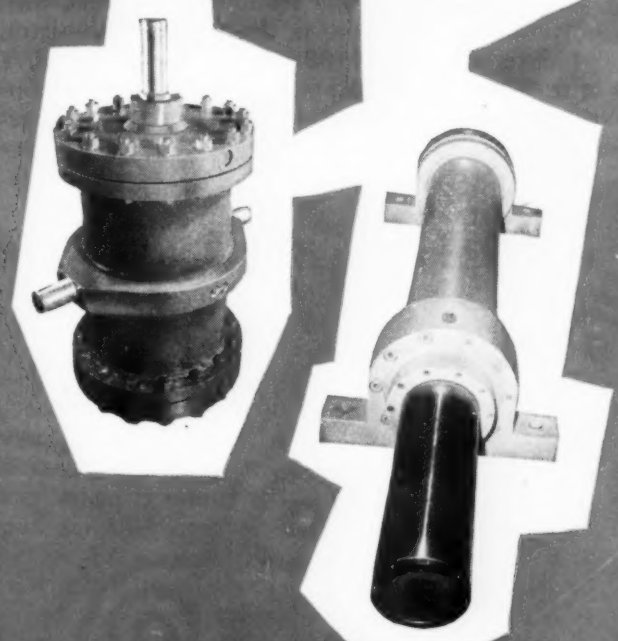
SPECIAL CYLINDERS

LINDBERG AIR CYLINDERS HYDRAULIC CYLINDERS

SHORT CYLINDERS

LONG CYLINDERS





Lindberg's full line of standard air and hydraulic cylinders is backed up by years of experience as "special cylinder specialists."

From coast to coast, you'll find that most of the special cylinder installations . . the tough jobs that require extra engineering skills and efforts . . are by Lindberg. In a mid-western sheet and tin mill, you'll see Lindberg Cylinders powering a conveyor system. In a southern aluminum plant, you'll see Lindberg Cylinders on aluminum ingot casting equipment. In an eastern steel plant, you'll see Lindberg Cylinders on large materials handling installations.

From out-of-the-way lumber camps in the north woods . . to sprawling textile plants in the southeast . . and busy food processing plants in the west, you'll find that the "special" installations . . the unusual installations . . the difficult-to-design installations are by Lindberg.

We also build a full line of standard cylinders which are just as good!

For additional details, ask for bulletin #731, "Lindberg Air Cylinders" and bulletin #701, "Lindberg Hydraulic Cylinders".

AIR . . HYDRAULIC

LINDBERG CYLINDERS

Lindberg Engineering Company
2450 West Hubbard Street, Chicago 12, Illinois

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

PILOT CHECK VALVES . . . Specifically designed for locking a cylinder or part of a circuit, these valves are the subject of catalog sheets published by Fluid Controls, Inc. The valves are used on hydraulic clamping devices where a slight leakage would cause a loss of clamping pressure. They are made with copper-brazed steel bodies for strength and trouble-free service. Important design feature is the area of the piston which is four times the area of the check valve seat. The catalog sheets are illustrated and contain complete engineering, design and construction data.

Circle 176 on Reader Service Card

PROTECTIVE SLEEVES AND BOOTS . . . In a new bulletin, BA1, offered by A & A Manufacturing Co., are illustrated applications for accordion, telescopic sleeves and boots. All sleeves of neoprene base material, are fabricated, round, square and rectangular or triangular to user's specifications. No mold is required in this new process. Applications shown range from two 28 inch sleeves operating horizontally on a coal mining rock drill to four sleeves 72 inches long and closing down, vertically over lead screws to a minimum, 3 inches closed length on a wire type stone cutter. The manufacturer is producing sleeves, for vertical uses, to length of 30 feet.

Circle 177 on Reader Service Card

CUSTOM MOLDED RUBBER PARTS . . . That's the title of Bulletin 5201A1 prepared by the Rubber Products Division of The Parker Appliance Company, which summarizes the company's new and expanded facilities in Cleveland, Los Angeles and Berea, Kentucky, plants for the high volume production of special synthetic compounds. Discussed are new methods and processes for custom molding of a wide variety of shapes, for a variety of applications, and sizes to customers' specifications.

Circle 178 on Reader Service Card

HYDRAULIC VALVES . . . Anco Incorporated has prepared brochures on their new rotary joint, relief valve and check valve for hydraulic service. Sectional drawings illustrate the compact design which has few operating parts and are light in weight. The rotary joint, to convey liquids at pressures up to 3500 psi, is available in pipe sizes for 1/4 to 5 inches. Check and relief valves have been developed for both high and low pressures.

Circle 179 on Reader Service Card

FLEXIBLE METAL HOSE . . . A two-color bulletin on flexible metal hose has been prepared by the Chicago Metal Hose Division of Flexonics Corporation. The brochure emphasizes the wide range of hose types and assemblies available. Some of the more common flexible hose installations are illustrated and a handy application chart, showing the type of assembly to use for handling various kinds of liquids, gases, solids and semi-solids is provided.

Circle 180 on Reader Service Card

OIL HYDRAULIC CYLINDERS . . . The Fishburne Machine Company has developed a line of standard oil hydraulic cylinders for use in 2000 psi hydraulic systems, which is described in Bulletin FM-1. Compact steel cylinders are offered in all standard sizes and mountings. Screwed on castings which allow universal piping positions, boltless end castings, leakproof gasket seal and cup packing that wipes away dust from cylinder wall are among the many features of these improved cylinders. Standard bore sizes are from 1 to 8 inches in any practical length stroke.

Circle 181 on Reader Service Card

BRONZE PARTS . . . A 12-page brochure on bronze bushings, bearings, bar stock and babbitt metal has been issued by the American Crucible Products Company. It includes description of various metals with much technical data on bronze. Running clearances, fits, lubrication, oil grooves, chemical and physical properties are covered in detail and typical case histories with illustrations are featured.

Circle 182 on Reader Service Card

For more reviews of recent literature turn to page 96

Circle 32 on Reader Service Card

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

Eastman

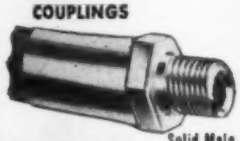
HYDRAULIC HOSE ASSEMBLIES

Specify **Eastman** *first in the field*

HYDRAULIC HOSE ASSEMBLIES

for the best performance, for long life and satisfaction—*all along the line*—from manufacturer to user. Check your needs on the following list:

COUPLINGS

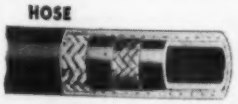


Solid Male

Swivel Male

Swivel Female

HOSE

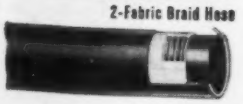


1-Wire Braid Hose

2-Wire Braid Hose

1-Fabric Braid Hose

2-Fabric Braid Hose



Spiral Wire Hose

Write for free catalog 101 on Eastman hose couplings and fittings.

Every movement and adjustment performed hydraulically

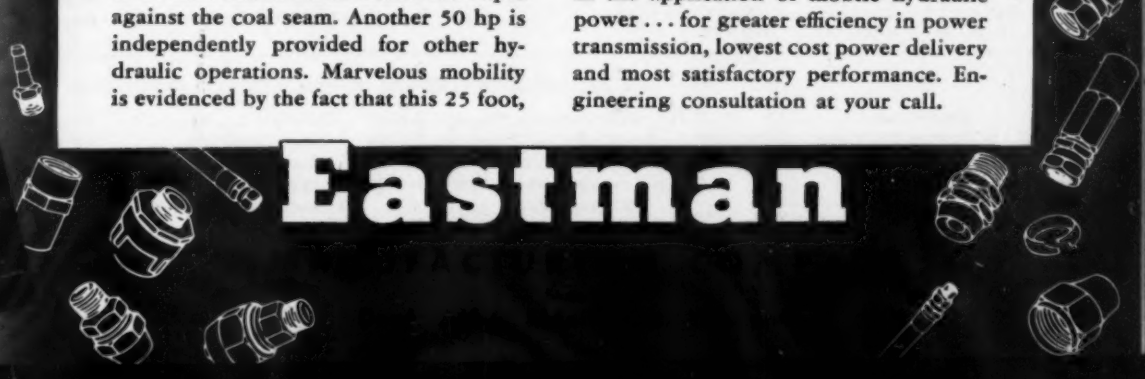
- Drives arms that mine the coal.
- Forward, back—right or left.
- Raising, lowering cutting head.
- Tilting heads to follow veins.
- Separating heads for higher cut.
- Raising discharge conveyor.

The mechanical marvel shown in operation here . . . the 76-B Jeffrey COLMOL . . . is indeed a "mighty mole," capable of tunneling into a coal vein at a speed of two feet, or more, per minute—delivering from 50 to 100 tons of coal per man day.

Every movement and adjustment is hydraulically controlled through Eastman Hydraulic Hose Assemblies. Over 2000 psi is applied through 1¼" Eastman double braided hose, delivering 140 hp to 10 coal cutters which rotate at 50 rpm against the coal seam. Another 50 hp is independently provided for other hydraulic operations. Marvelous mobility is evidenced by the fact that this 25 foot, 35 ton monster can turn around in its own length.

The Jeffrey Mfg. Co., pioneers in the coal mining equipment field, have used Eastman Hydraulic Hose Assemblies on all their machines for over 20 years. Eastman Manufacturing Company, pioneer in its own field, too—is proud to have played a part in the development of the Jeffrey line.

Call upon our 25 years of experience in the application of mobile hydraulic power . . . for greater efficiency in power transmission, lowest cost power delivery and most satisfactory performance. Engineering consultation at your call.



Eastman

NATIONAL OIL SEAL LOGBOOK

Reprints from this or other Logbook pages are available for your files. Request them from our Redwood City, California office

Figure 1. Bendix Depth Stop Cylinder

Ten O-Rings, Oil Seal solve pressure and dirt problems in compact Bendix Depth Stop Cylinder

The 3½" x 8" Depth Stop Cylinder is one of a line of cylinders manufactured by Bendix Pacific Division for the agricultural trade. Designed specifically for the operation of tractor-drawn tools, this cylinder has proven sufficiently rugged to be used for the operation of dozer blades, scrapers, etc. Operating conditions require sealing at ten points. Ten-O-Rings plus a rod wiper (oil seal) are used.

Bendix specifications provide that with the piston extended and 1,000 p.s.i. at one main port, there shall be no leakage at the opposite port. Also, with the poppet rod compressed and 300 p.s.i. at one port, leaks at the opposite port shall not exceed 7 c.c. in the last minute of a four-minute period.

This high order of sealing is achieved by the use of precision-made National O-Rings in both dynamic and static applications (Figure 1). O-Ring sizes vary from ½" to 3½" O.D. Dynamic applications are all of the reciprocating type, and S.A.E. #10 oil is used in the system.

Where the piston rod passes through the cylinder head, a National 340,000 Syntech* oil seal is installed to exclude heavy concentrations of dirt, dust and mud. This seal has a synthetic rubber sealing member of springless design, bonded to a rigid steel inner member. The seal O.D. is also rubber covered to provide a positive seal against the cylinder head bore. (Figure 2)

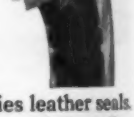
National O-Rings and the seal used in this assembly are all standard units available without special engineering. National offers a complete line of quality O-Rings and over 2,500 standard-design oil seals. Whether your sealing problem requires special engineering or can be met with standard National sealing devices, National Applications Engineers are at your service. Call the nearest National office for information.

Figure 2. National 340,000 Syntech

*Trade Mark Registered

Sealing News & Tips

National 30,000 series Seals



Have a heavy-duty sealing problem involving lubricant retention and dirt exclusion? Investigate National 30,000 series leather seals. Impregnated spring-loaded sealing lip retains grease or oil; tough springless outer wiper excludes foreign matter. Steel outer case press fits into bore or housing.

National O-Ring Catalog

Includes engineering, design and compound data, gland groove and back-up ring requirements, practical engineering suggestions. Lists all National O-Rings. Request free copy on letterhead, giving position or title.

"Let Your Decision be Based on Precision"

NATIONAL
OIL & GREASE SEALS
O-RINGS SHIMS

NATIONAL MOTOR BEARING CO., INC.
General Offices: Redwood City, California
Plants: Redwood City, Calif.; Downey (Los Angeles County), Calif.; Van Wert, Ohio

CALL IN A NATIONAL APPLICATIONS ENGINEER

CHICAGO, ILL. . . . *Room 4113 Field Building, FRanklin 2-2847*
CLEVELAND, OHIO . *210 Heights Rockefeller Bldg., YEllowstone 2-2720*
DALLAS, TEXAS . . . *30½ Highland Park Village, JUstin 8-8453*
DETROIT, MICH. . . . . *726 Lothrop Avenue, TRinity 1-6363*
DOWNEY (Los Angeles Co.), CALIF. . *11634 Patten Rd., TOpaz 2-8166*
MILWAUKEE, WIS. . . *647 West Virginia Street, BRoadway 1-3234*
NEWARK, N. J. . *Suite 814, 1180 Raymond Blvd., MItchell 2-7586*
REDWOOD CITY, CALIF. . . *Broadway and National, EMerson 6-3861*
WICHITA, KANSAS . . . . *519 South Broadway, WIchita 2-6971*

Eastern Engineers Hear Hydraulic Papers

The second meeting of the Fluid Power Systems Group, an activity of the Hydraulics Division, ASME, was held on April 8 in the Engineering Bldg., University of Pennsylvania. Chairman J. S. Bennett presided. The large number who attended heard two excellent papers, abstracts of which follow.

Aircraft Problems

HARRY P. KUPIEC, General Manager, Aircraft Equipment Testing Company, in his paper "Problems Relating to Aircraft Hydraulics" surveyed the introduction and development of hydraulic components and systems and materials to aircraft. He stated that the first use of hydraulics to airplanes was in the air-oil hydraulic shock absorbers. As plane speeds increased, parasitic drag became greater and landing gear was first streamlined (the old familiar "pants"), then taken out of the slipstream. Such retraction was first by manual and mechanical devices, then by a simple hydraulic system using a hand pump. As plane speeds and weight of landing gear increased it was essential to retract landing gear faster. Since hydraulics proved more efficient than electrical power when one or more hp was required, the trend was toward hydraulics. At present practically all aircraft use hydraulic power to retract landing wheel structures.

With plane size and weights increasing, manual hydraulic brakes (master cylinder) became inadequate. Power brakes had to be used even on single place fighters. The development of hydraulic power applications to aircraft was due to the excellent cooperation within the airframe industry and between government and industry designers and engineers.

On the earliest hydraulic systems operating pressures varied with each designer and aircraft. In 1940 three sets of operating pressure ranges were set up by agreement: 1000, 1500 and 3000 psi. Tests indicated

Continued on page 36

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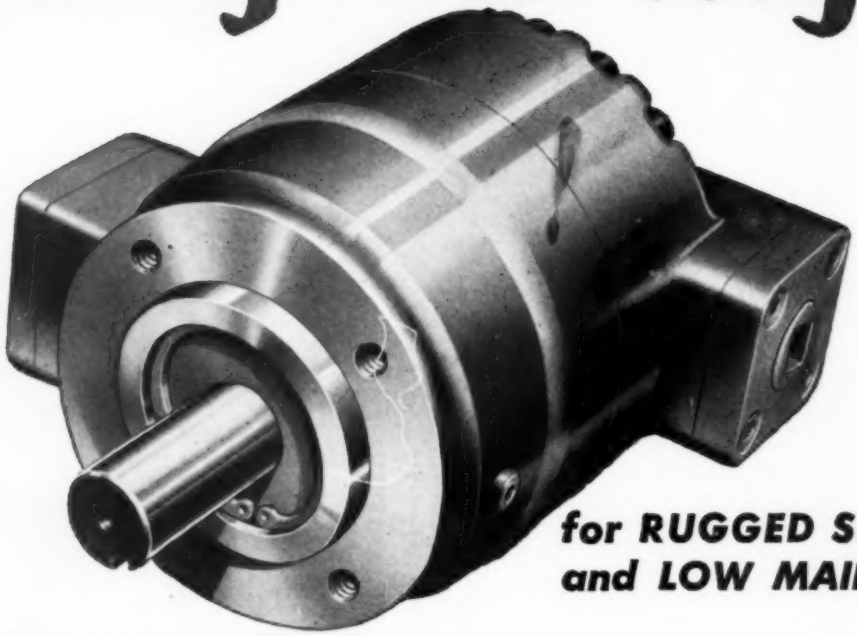

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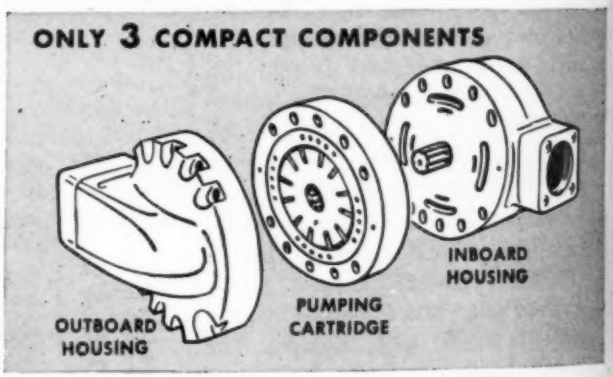

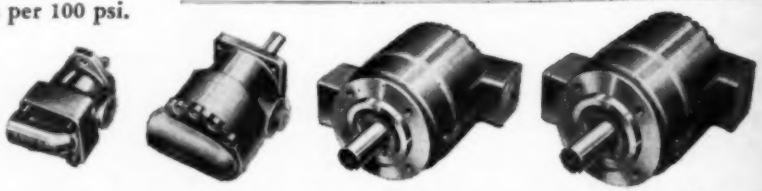

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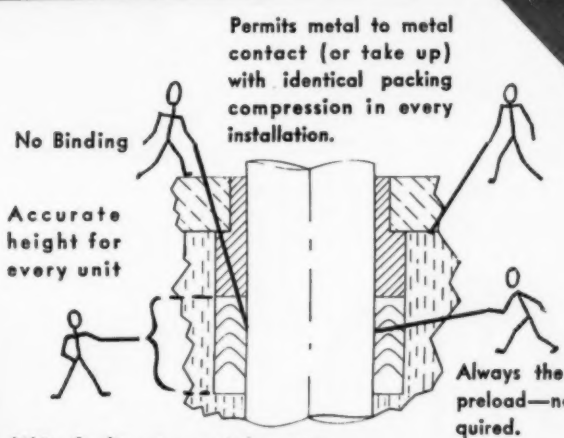
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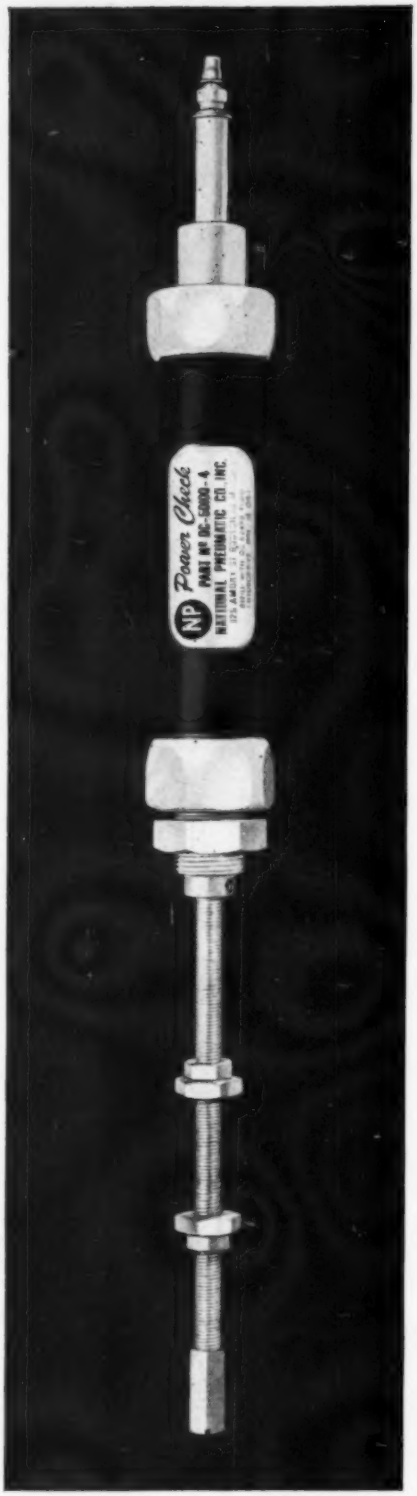

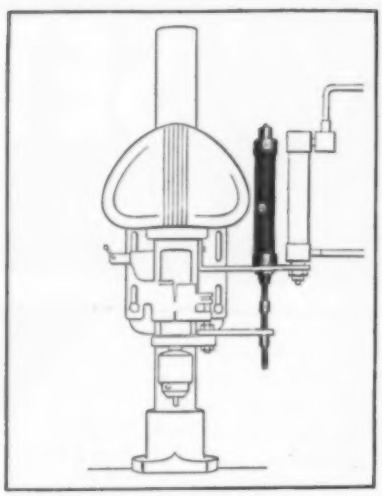

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Continued from page 33

that for a 90 percent efficiency and a stress of one-sixth of ultimate, the lowest weight per hp for aluminum tubing was 1500 psi and for stainless steel a very flat curve between 3000 and 5000 psi.

Early hydraulic fluids were a combination of alcohol and glycerine, dyed blue for identification. Almost all aircraft from 1940 to 1948 used a mineral base hydraulic fluid which was steadily improved to meet -65 F operational requirements and give a pour point of -80 F. This was the familiar red fluid. The two fluids could not be used interchangeably, the blue fluid requiring natural rubber and seals, the red required synthetic rubber packings.

In 1940 the first joint Army-Navy Specification was written covering aircraft hydraulic systems. First known as AN-H-2, this spec is now MIL-H-5440. Subsequently specs were created for practically every hydraulic component used in aircraft systems.

Nonflammable Fluids

Nonflammable fluids made their appearance in the post-war period. Skydrol, used by airline operators, has a much longer operating life than mineral oil, has a high lubricity and is non-corrosive to aircraft metals and alloys. BuAer has used a hydrolube for several years with apparent success except for persistent corrosion. Other nonflammables are under development and test. The Air Force is still unsatisfied with present fluids and is spending considerable time in testing proposed fluids.

While flexible hose are meeting the present spec (MIL-F-5070), operating pressures of all sizes except -4 and -5 are below 3000 psi. Better hose is an urgent need.

Aeronautical engineers are never satisfied with the weight of any piece of equipment or structure. Simplicity of aircraft hydraulic systems, difficult in the face of increasing functions, is an important factor in weight saving. A good measure of weight of power components used to be one pound per

Continued on page 38

THE PLACE: RANGERS DIE CASTING COMPANY, Lynwood, California

THE STORY:

Soaked in PYDRAUL . . . Not in Flames

Die-cast products of several kinds are made on the 8 machines in this shop. Two weeks after switching from conventional hydraulic fluid to Monsanto *Pydraul*—and unknown to the operator of a cold-chamber aluminum die-casting machine—an electrical circuit failed.

Operator continued to run the machine until the nitrogen in the accumulator unloaded into the oil reservoir, blowing *Pydraul*, which is fire-resistant, twenty feet into the air—all over the machine, operator, helper, and directly into an open pot of molten aluminum.

THE POINT OF THE STORY:

"Instead of a flash fire and serious burns to several workmen, we suffered only to the extent of two fluid-soaked workers and 40 gallons of *Pydraul*." *Paul T. Harlow, President.*

How safe is the fluid in *your* hydraulic lines today? Without any alterations in equipment, the change-over to *Pydraul* can be made.

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Aircraft Hydraulics

Continued

hp; today some hydraulic pumps give one hp for a quarter of a pound of weight. One type pressure regulator accommodates 30 hp with only 14 ounces of weight. Hydraulic motors are also made in the magnitude of 4 hp per pound of weight.

Specifications are written to accommodate the designer; they make clear what is needed but are sometimes left with important omissions. For example, when the sequence of testing or the latitude of tolerances are not specified, variable test procedures give a wide range of results.

The introduction of improved testing equipment like the cathode ray oscilloscope for pressure pulsation (and other) analysis and the electronic flow meter for accurate answers to flow measurement problems have done much to help standardize test results.

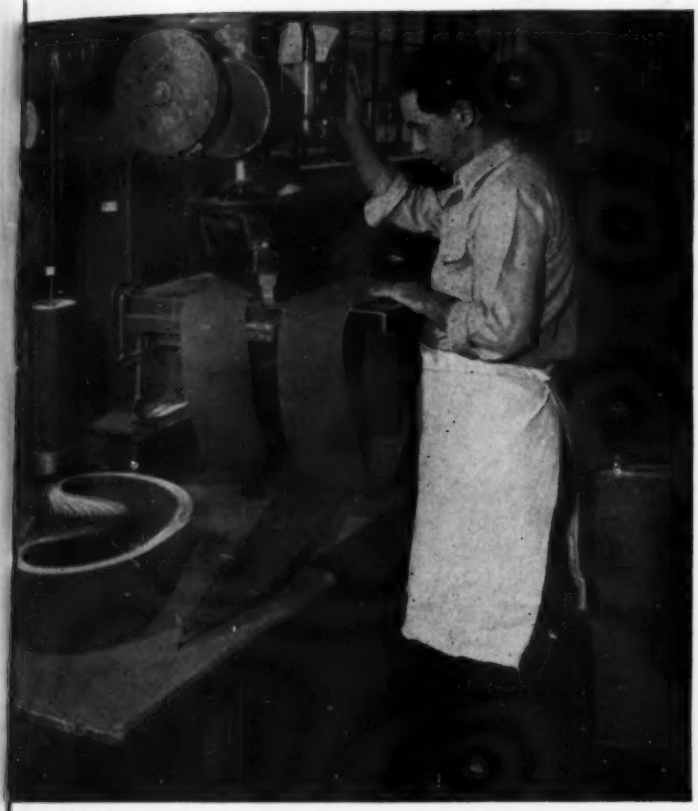
The advent of titanium is of great interest to the aircraft hydraulic engineers. This light, strong, corrosion resistant metal has many properties which appear to be superior to those of other metals used in the manufacturing of aircraft hydraulic equipment. Evaluation tests are now being made at Wright Field.

Lift Truck Hydraulics

O. S. CARLISS, Director of Engineering, The Yale & Towne Manufacturing Company, limited his remarks to the application of hydraulic components to power operated fork and platform trucks. He classified the main functions of an industrial truck as: (1) propulsion of the truck; (2) hoisting of the load; (3) tilting of load carrying channels forward or backward; (4) clamping of loads; (5) side shifting devices for accurately loading loads; (6) rotating devices; (7) push-pull devices for automatic loading and unloading; (8) power operated steering devices for heavy capacity trucks; and (9) rotating of scoops or shovels for

Continued on page 40

SERIOUS PRODUCTION LOSS STOPPED BY SWITCH TO SUNVIS H.D. 700 OILS



VARNISH NO OBSTACLE—This is one of the many presses of various sizes which form joints in abrasive sanding belts for production use in the automobile, jet engine and woodworking industries, as well as many others. Six years ago equipment like this press needed costly maintenance at frequent intervals because of varnish formation. Then a Sunvis H.D. 700 Oil was adopted as the hydraulic medium, and the trouble disappeared like magic.

NO OIL CHANGE—This large press is used for joining abrasive belts used in polishing stainless steel. Although the oil temperature at which it operates is 130 F, the 200-gallon charge of Sunvis H.D. 700 is still in excellent condition after nearly four years' use.

Among the 30,000 types of abrasive specialties made by Behr-Manning Corporation, Troy, N.Y., Division of Norton Company, are sanding belts requiring smooth, uniform joints. Dozens of hydraulic presses, ranging in capacity from 5 to 150 tons, form the joints to the same thickness as the belts.

The hydraulic oil in use six years ago created a production obstacle by forming varnish in the pumps and valves. At least once a year the systems had to be overhauled and the pumps sent to the manufacturer for repairs, with consequent production loss.

Behr-Manning then changed to Sunvis H.D. 700 Oils, as suggested by a Sun representative. Because of the detergent-dispersive characteristics and high stability of these oils over a wide range of speeds, loads and temperatures, varnish formation was immediately cleared up. Since that time, no overhauls traceable to oil have been necessary. Annual savings in pump repairs have been substantial and no oil changes have yet been required.

For complete information about "Job Proved" Sunvis H.D. 700 Oils, fill out the coupon below.

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You get these advantages in Tannate Leather Packings: They have a low coefficient of friction; do not cold flow: will not score or abrade. They do not require lubrication, and they can be stored indefinitely without loss of tensile strength. Tannate packings are "custom-manufactured" to operate efficiently over a wide range of pressures and temperatures—from sub-zero to over 200° F.—and with different types of mediums.

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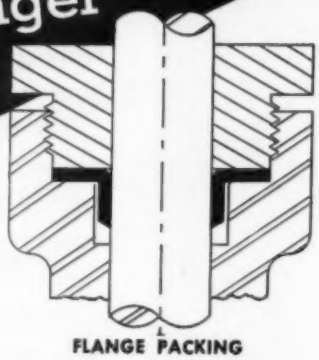
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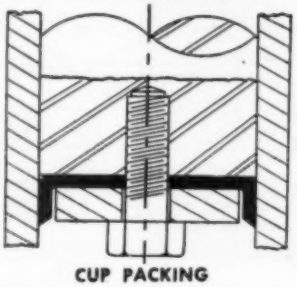
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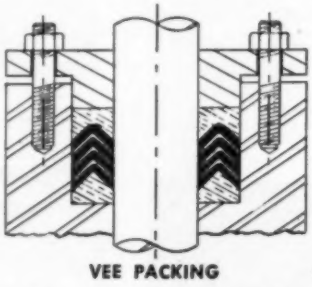
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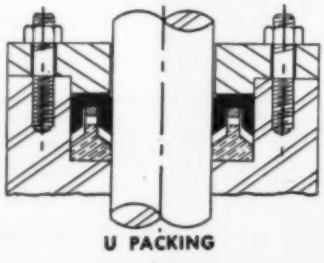
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handling bulk material around the horizontal axis.

Originally fork and platform trucks were developed with electromechanical means to perform functions. With the advent of gas and diesel power, hydraulic control provided a ready means to perform the same functions much more simply. Advantages included variable speed of operation, sensitivity of control, simplification of controls including the elimination of limit switches, lower costs of manufacture, automatic means of providing protection against over-loads and greater flexibility in the operation of more accessories.

Basically the hydraulic system calls for a continuously operating pump and a multiple spool valve to control the several functions. There is a marked tendency to use more and more auxiliary attachments in order to obtain more work from an individual piece of equipment. In addition to standard tilt and hoist functions, two or three auxiliary functions, such as clamp, side-shift, rotate or combinations of these, are being added.

The one disadvantage of hydraulic controls, the multiplicity of hoses required, is being reduced by the use of a solenoid operated valve, which when used with a single auxiliary spool, permits the operator to select any one of the additional functions which may be required.

Hydraulic Circuits

The hydraulic circuits employed in the usual industrial truck for hoisting and tilting are quite simple. We normally use either a vane or gear type pump, a multiple spool valve, double acting type tilt cylinders and a single acting type hoist cylinder.

The Hydraulic Pump

We generally use a gear or vane type pump in a range of capacities from 2 gpm to as high as 70 gpm. Formerly we restricted operating pressures to 1500 psi; current designs are being based largely upon operating pressures of approximately 2200 psi. This figure is based up-

Continued on page 42

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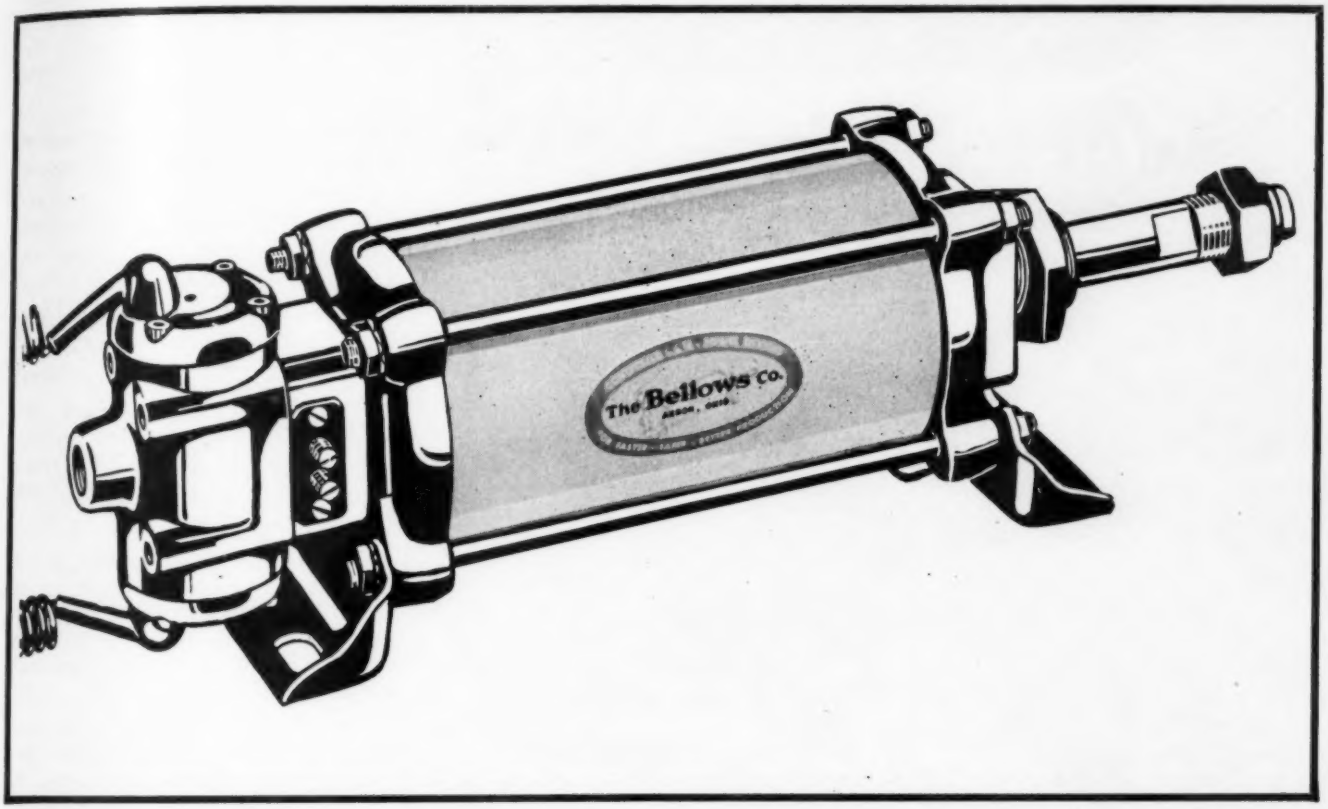
And The Bellows Air Motor is the only Air Cylinder with a choice of BUILT-in Valves



In pneumatics operation the closer the valve to the cylinder, the quicker, more positive the action. In the Bellows Air Motor the valve is *integral with the cylinder.* This integral construction means instant action. No lag, no delay, no air flow restriction. Integral construction means positive control over piston rod direction . . . over piston rod speed. It means compactness — space-saving design . . . simplified installation in cramped quarters, or on moving machine elements.

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All Bellows Air Motors, with any integral valve control, are available in five bore sizes: 1¼″, 1¾″, 2½″, 3⅝″ and 4½″ and in standard stroke lengths up to 48″.

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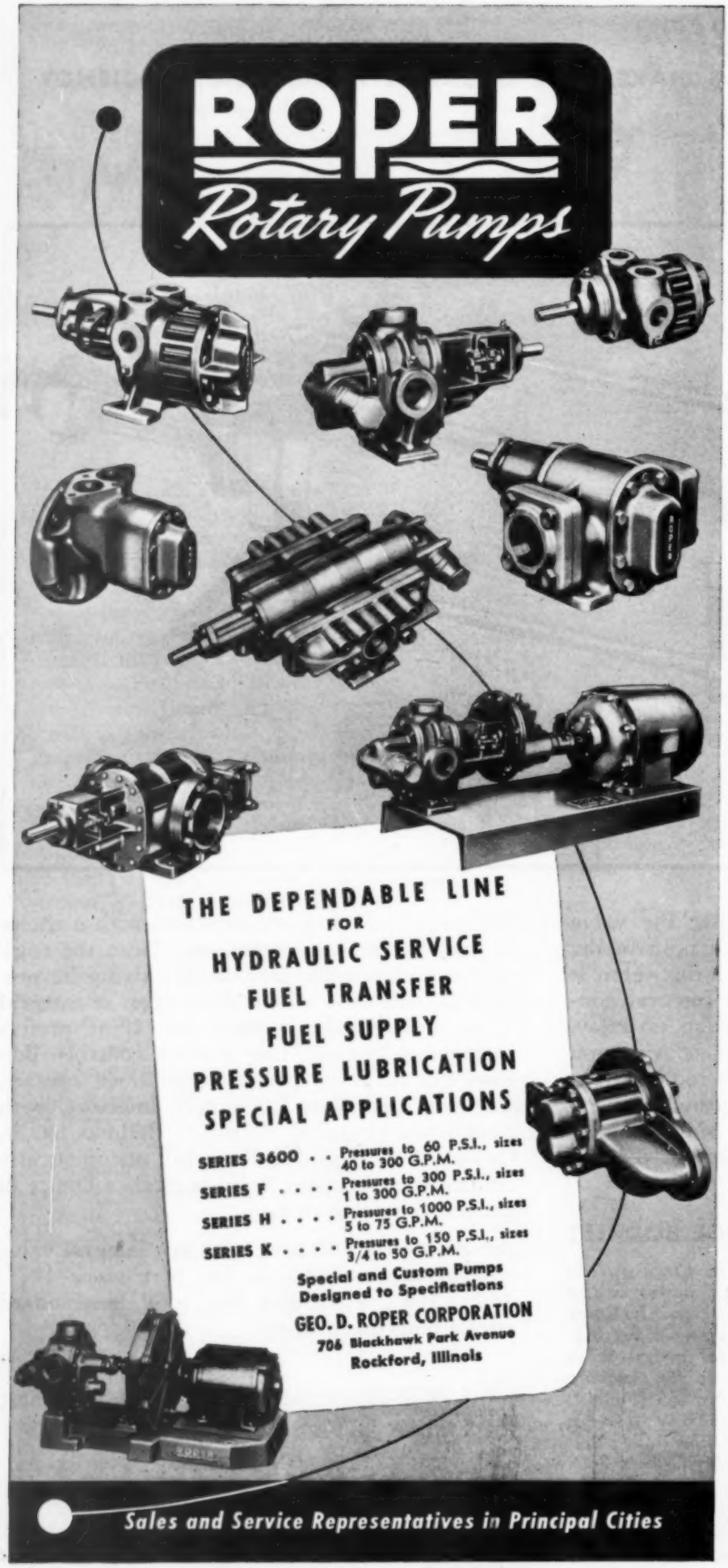
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Lift Truck Hydraulics

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on the ability of manufacturers of pumps and valves to supply standard equipment which would have a reasonable life expectancy. In the gas and diesel power trucks, pumps are driven directly through a flexible coupling, through gearing or by means of "V" belts. The "V" belt drive, with a spring take-up, has proven very satisfactory in the standard line of 4000 to 8000 pound capacity range trucks. Pump bearings are given very careful attention, particularly when a gear or belt drive is used because of the radial load imposed on the bearings. The pump must be capable of standing the shock loads imposed by the frequent operation of the relief valve. Most applications, except some of the smaller units, operate at pump speeds of about 1800 rpm.

Hydraulic Control Valves

A two spool hydraulic control valve is used in the standard fork truck. With one additional function called for we use a three spool valve; for two additional functions we use either a four spool valve or a three spool valve and a solenoid operated valve. For more than four functions we use a three spool valve and solenoid operated selector valves. A series type spool valve has been found to be best suited. Built-in check valves are used.

Pressure Regulator Valve

When it is necessary to limit the pressure applied, particularly to an auxiliary device to some valve below that required for the normal hoisting and tilting function of the truck, an adjustable secondary pressure release valve is usually provided. This is placed in the circuit beyond the main control valve. This device operates in the usual manner, balancing the hydraulic pressure against an adjustable spring pressure.

Flow Control Valves

These valves are commonly used to control the speed of lowering to within safe limits regardless of whether the truck is loaded or empty. These valves are placed

Concluded on page 45

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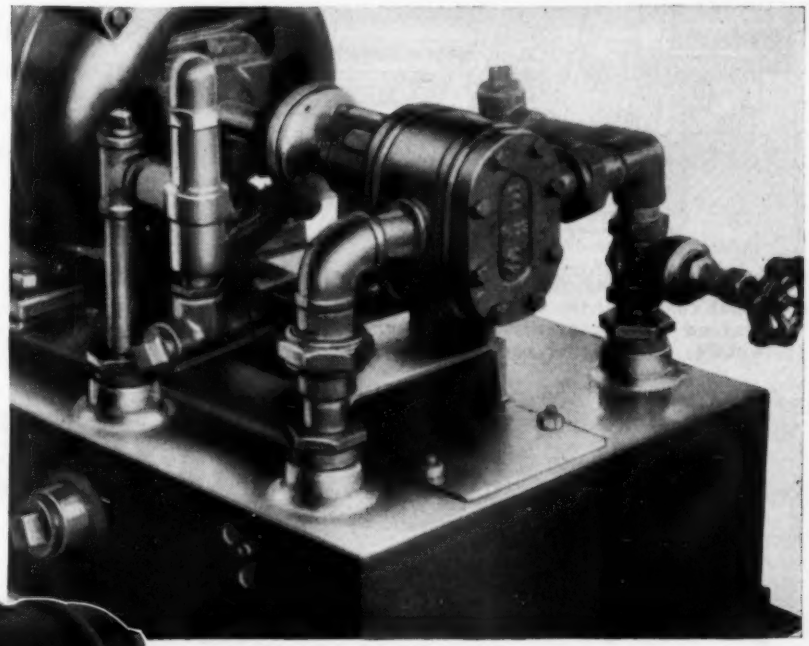
You can point with pride to a quiet operating pump that gives smooth flow and long service when you equip your machines with Brown & Sharpe Rotary Geared Pumps. Made with helical gears of extreme accuracy and operating on antifriction bearings, these pumps efficiently deliver large volumes of oil at high speeds and under pressures up to 200 psi. The No. 53 supplies up to 23 gpm. and the No. 55 supplies up to 34 gpm. They may be direct, gear, or pulley driven. An excellent mechanical seal eliminates all leakage worries.



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THE PUMP WITH THE GEARED WOBBLER

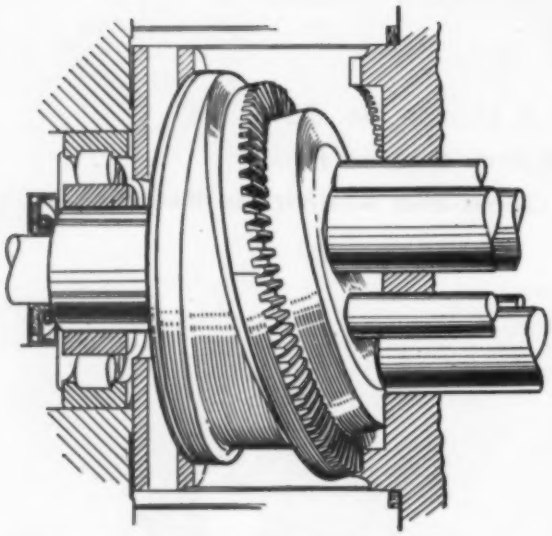

Diagram showing the geared mechanism which constrains the wobbler to revolve at a speed which prevents scuffing between wobbler and plunger ends.

This pump embodies all the well-tried features of our Straight-in-line pump, employing seated valves and using low viscosity oils. It is suitable for direct drive at speeds up to 1,800 r.p.m. and for working pressures up to 9,000 p.s.i.

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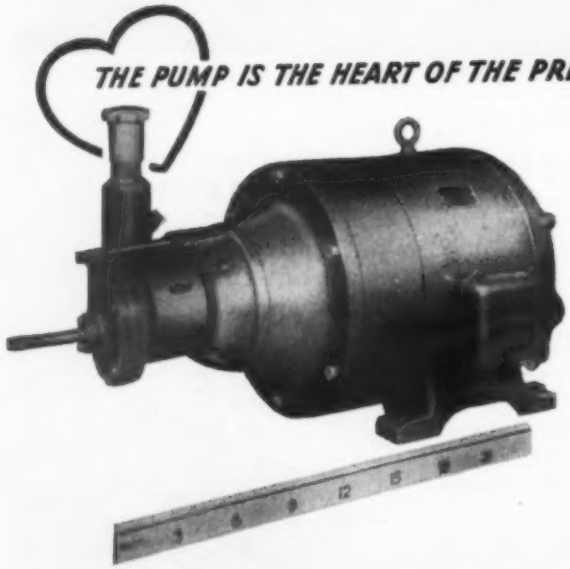

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Lift Truck Hydraulics

Continued from page 42

either within the hydraulic cylinder or as close as possible to it. We consider this an important safety function in controlling the rate of descent in the event of the bursting or accidental cutting of the high pressure hose to the hoist cylinder.

Hydraulic Cylinders

Double acting cylinders are normally used for tilting. We favor units with removable heads so that the "V" or double cup packing may be readily serviced. Because cavitation will sometimes occur when the tilt cylinder control valve is operated in the direction to cause the unit to tilt forward with a load and when the pump is not operating or at a speed insufficient to supply fluid to the back end of the piston as fast as the load is forcing fluid out of the forward end. To avoid this, we employ a pilot operated check valve with a dash pot, which does not permit the fluid to be discharged from the rod end of the tilt cylinder unless sufficient back pressure is developed on the other side of the piston, insuring that the piston end cavity is filled with fluid at all times.

Hydraulic hoist cylinders are usually single acting, either ram or piston type and equipped with drainbacks. In the industrial truck industry each type of cylinder is used with approximately equal success. We also use a duplex cylinder of rather interesting design to permit elevation of loads to greater heights without increasing the overall height of the truck. Other manufacturers employ tandem cylinders to achieve the same result.

One of the more important factors in the application of hydraulic cylinders to our equipment has been the guidance of the hoist cylinder. We found it necessary to avoid any restraint of the cylinder from seeking its own alignment in an extended position. We provide a spherical seat for the base mounting of the cylinder to permit it to seek its own alignment in an extended position. Recently, we have been using a hollow piston rod and guiding the rod internally at its upper end. This has given improved operational characteristics.

POSITIVE ASSURANCE

Here is the Back-Up Ring No Hydraulic Fluid Can Attack

SPIRAL TYPE RING

Made in three types—solid rings, split rings, and the popular improved spiral type ring (illustrated), for quick easy installation.

Chem-o-green Back-Up Rings, made of TEFLON* colored green for identification, answer the "O" Ring extrusion problem.

- Chemically inert, non-corrosive—chemical inspections can be eliminated.
- Zero swelling in all hydrocarbons and newer synthetic fluids.
- Service temperature range from minus 110° F to 500° F.
- Waterproof. Non-flammable.
- Requires no water soak to swell ring for installation.
- Unsurpassed anti-friction properties. Won't adhere to any surface.

Made in all standard sizes for use with "O" Ring Packing, Gaskets and Universal Tube Fittings.

Companion product to United States Gasket Company's Chemiseal "O" Rings—a complete line of homogeneous synthetic rubber packings made in both commercial and AN compounds.

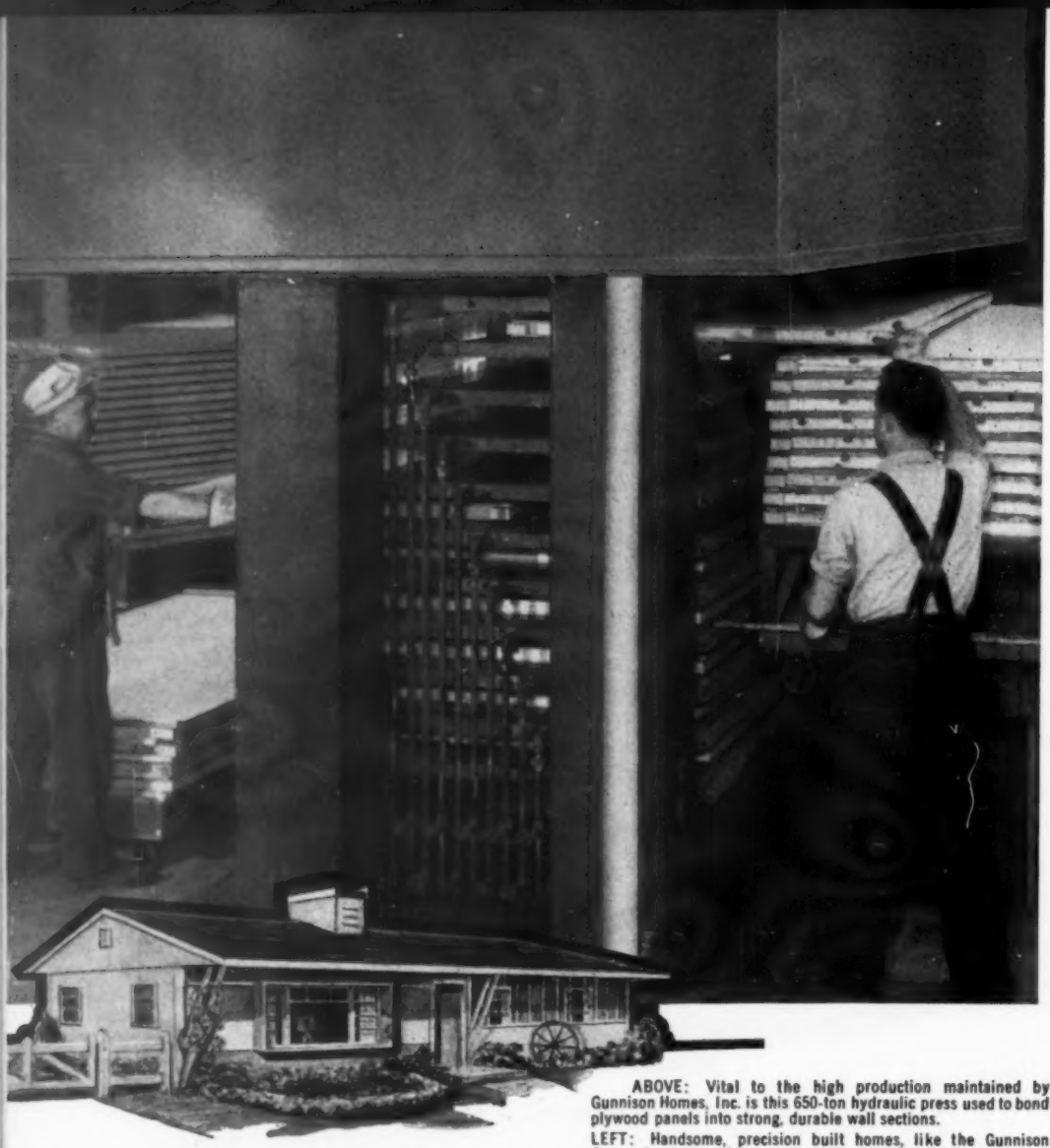
Standardize on this "Packing Package" for the advantages one source and one responsibility can offer you. Write for Bulletin OB-1152.

*du Pont's trademark for its tetrafluoroethylene resin.

UNITED STATES GASKET COMPANY

FLUOROCARBON PRODUCTS DIVISION
CAMDEN 1, NEW JERSEY

Representatives in Principal Cities Throughout the World



ABOVE: Vital to the high production maintained by Gunnison Homes, Inc. is this 650-ton hydraulic press used to bond plywood panels into strong, durable wall sections.

LEFT: Handsome, precision built homes, like the Gunnison Coronado pictured here, are built in a matter of hours.

Answers a pressing need for Gunnison Homes, Inc. . . .

● Gunnison Homes, Inc., situated in New Albany, Indiana, is one of the leaders in the field of manufactured homes. Key to continuous production of precision built homes at the New Albany plant is the 650-ton hydraulic press, shown above, which was installed in 1947. This press processes ten plywood panels every cycle by the combination of heat and pressure . . . a tough job and one requiring reliable hydraulic performance to maintain production schedules.

STANOIL
TRADE MARK
Industrial Oil

STANOIL Industrial Oil was installed in the press when it was put into operation six years ago. STANOIL has stood the test of severe operation . . . with no evidence of oil deterioration being found during a recent inspection of the hydraulic system. Operation has been efficient. Minimum make-up oil has been needed to maintain the oil capacity of 450 gallons.

Find how STANOIL can benefit you by discussing this multi-purpose oil with a Standard lubrication specialist. You can contact him by phoning your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

What's YOUR problem?

Ralph E. Murnahan, of Standard Oil's Evansville office, is the lubrication specialist who keeps in constant contact with Gunnison Homes to make certain that there is no interruption of operation due to lubrication difficulties.

He is one of many lubrication specialists who make their headquarters in Standard's offices throughout the Midwest. These men have been specially trained in Standard's Lubrication Engineering Schools and, in addition, have a wealth of on-the-job experience.

To obtain the service of the lubrication specialist in your area, you need only call your local Standard Oil office. The lubrication specialist will discuss your lubrication problems with you . . . at no obligation to you, of course. He has a complete line of petroleum products to offer you, including:

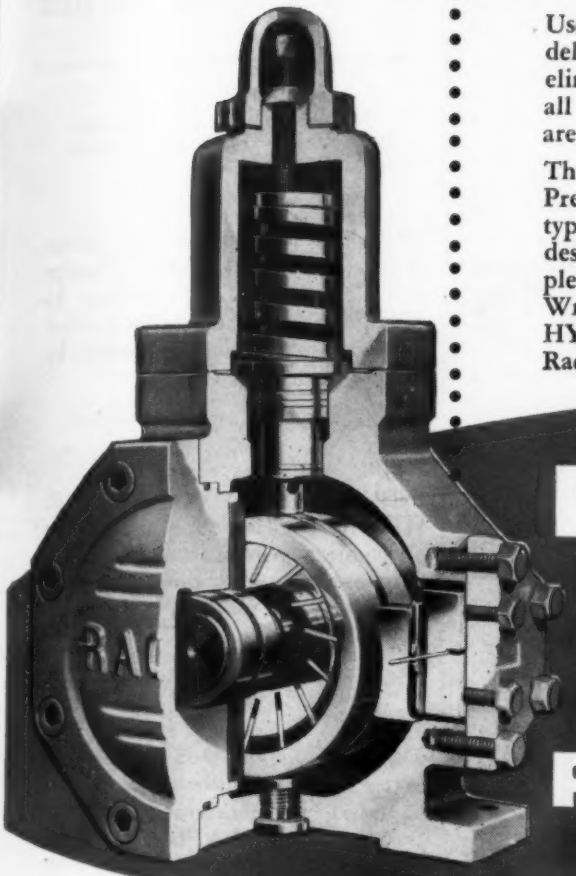
SUPERLA Greases—Available in a wide range of consistency grades and in both lime-soap and soda-soap types. SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

STANOLITH Greases—Because these unique lithium soap products possess the heat resistant properties of soda-soap greases and the water resistant properties of lime-soap greases, they offer a solution to lubrication problems caused by the presence of both heat and water.

STANDARD OIL COMPANY STANDARD *(Indiana)*

Put ALL of the Oil to Work

Simplify the Circuit and Improve Its Efficiency



Use RACINE Variable Volume Pumps; they automatically deliver only the exact volume required. Relief valves are eliminated. Heating is reduced, horsepower saved. Overall cost of circuit components is less. These advantages are yours when you "put all of the oil to work."

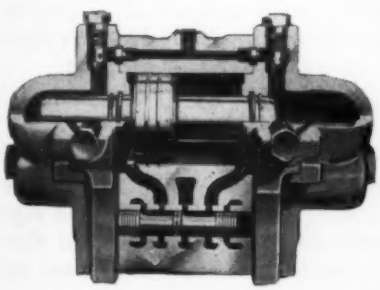
The RACINE Line is complete. Pumps to 30 G. P. M. Pressure Boosters to 5000 P. S. I. Balanced piston sleeve-type 4-way valves, straight-way valves and controls, all designed for manual, electric or hydraulic operation. Complete factory and field engineering service without cost. Write for Free, complete 3-color catalog P-14-E. RACINE HYDRAULICS & MACHINERY, Inc., 2074 Albert Street, Racine, Wisconsin.

RACINE

Variable Volume

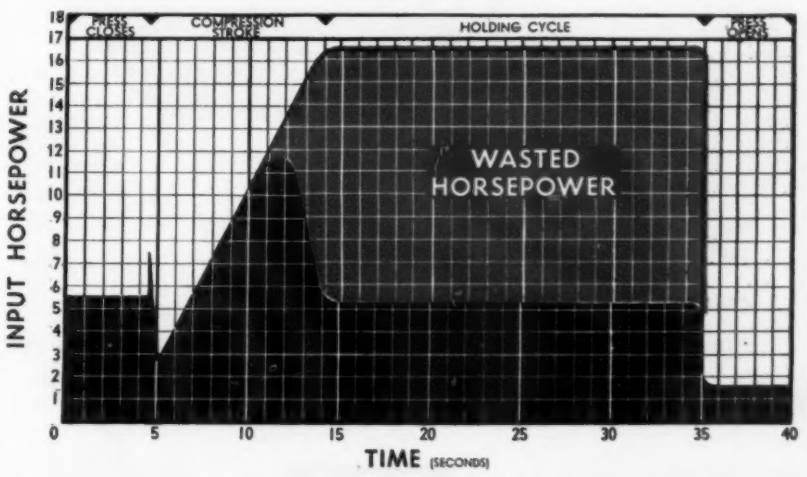
PUMPS

The black area in the chart below shows the H. P. consumed during one complete cycle of operation when a No. 6 RACINE Variable Volume Pump and 7:1 Pressure Booster is used. The red area shows the wasted additional H. P. required when an efficient 2-pressure, 2-volume Constant Volume Pump of equivalent size is used. Note the savings in H. P. Chart is based on the operation of a 200-ton molding press with a 10" ram.



RACINE
Hydraulic BOOSTER

A 7:1 ratio pressure booster was used in the circuit in chart at right. Pump pressure of 725 p.s.i. was increased to 5000 p.s.i. with no increase in H. P. Racine Pressure Boosters are available in 3:1 to 7:1 ratio sizes.



RACINE

STANDARD FOR QUALITY AND PRECISION

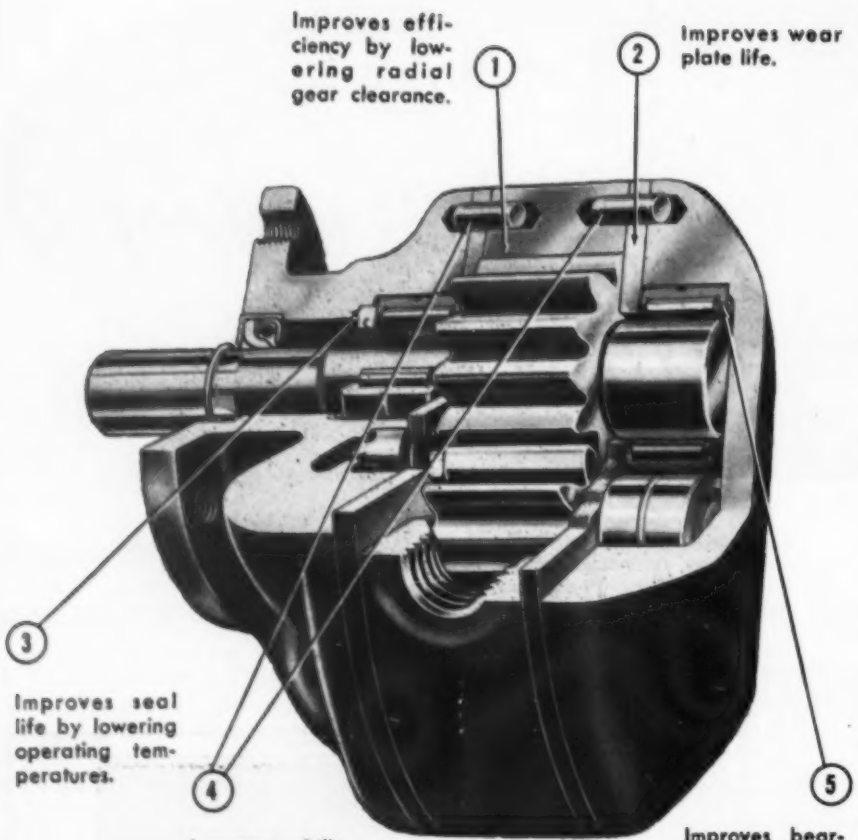
← Circle 115 on Reader Service Card

FIVE WAYS 5

PITCHLIGN
Trade Mark

BEARINGS

Improve GEAR PUMPS


1
Improves efficiency by lowering radial gear clearance.
2
Improves wear plate life.
3
Improves seal life by lowering operating temperatures.
4
Improves ability to operate with normal misalignment.
5
Improves bearing life by roll control at the pitch line.

Pitchlign is the only small diameter bearing with rollers guided at their pitch line by a cage supported on outboard flanges of the race.

Send For Technical Bulletin SF-6611 *Write Today!*

RBC

ROLLER BEARING COMPANY OF AMERICA
Sullivan Way, West Trenton, New Jersey

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

For more information circle numbers on the reader service card bound in this issue.

SCRAPER RINGS, to wipe piston rods, clean off dirt, dust and foreign materials to prevent damage to packings and cylinder walls, are featured in a catalog prepared by Gadgets Inc.

Circle 38 on Reader Service Card

INDUSTRIAL HYDRAULIC TUBE FITTINGS, designed especially for application in hydraulic circuits, instrumentation and power systems, are detailed in Catalog No. 53 published by the Deutsch Company.

Circle 30 on Reader Service Card

TRIPLE-LOK FITTINGS, leakproof under severe conditions of vibration, elevated temperatures and high pressure, are described in Tube Fitting Catalog 4300 available from The Parker Appliance Co.

Circle 91 on Reader Service Card

REGULATOR-FILTER-LUBRICATOR, all in one unit, whose installation involves only two pipe connections, is the subject of a catalog available from CCA Products Division, Breco Manufacturing Co.

Circle 17 on Reader Service Card

ROTARY COMPRESSORS, simple in design, easily operated and ruggedly built, are discussed and illustrated in Bulletin C-6 released by the Fuller Company.

Circle 37 on Reader Service Card

FLUID MOTORS, for simplified power transmission, incorporating such advantages as infinite range of speeds, eliminating old fashioned gearing and clutching mechanisms, etc., are described with complete specifications in Bulletin No. 113 offered by Sundstrand Machine Co.

Circle 117 on Reader Service Card

ANCHOR

ONE-WIRE BRAID HOSE ASSEMBLIES

for medium-and low-pressure service

Factory-assembled to your specifications—you get just what you need.

Long, uniform, positive grip assured by internally-threaded coupling shell.

Eliminates leaks and blow-offs in medium- and low-pressure service.

Sizes and types for every application — available with solid male or union male ends.

"O" ring seals prevent leakage between swivel ends and the coupling body.

Use of swivel male ends eliminates need for adapter unions, reduces the number of joints, and lets hose assume normal position when pressure is applied to the line.

Exclusive Anchor Max-Flo coupling gives you the equivalent of unrestricted flow through the couplings.

NEW! REVOLUTIONARY ANCHOR FLANCO SPLIT-FLANGE CLAMP

Positive leakproof connection *without* threaded joints. Bolt centers are located to distribute the forces evenly and prevent tilting of the clamp halves. Easy to assemble with small automotive-type wrench.

• • •

Get more information. Attach coupon to your letterhead and mail today!

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Main Office and Factory: LIBERTYVILLE, ILLINOIS

FACTORY BRANCHES: DETROIT, MICHIGAN • DALLAS, TEXAS

Anchor Coupling Co. Inc.
Dept. AH63, Libertyville, Illinois

Yes, I'm interested in

☐ Anchor one-wire braid hose assemblies

☐ New Anchor Flanco Split-flange clamp-type coupling

Send me information.

Name..... Title.....

Company Name.....

Company Address.....

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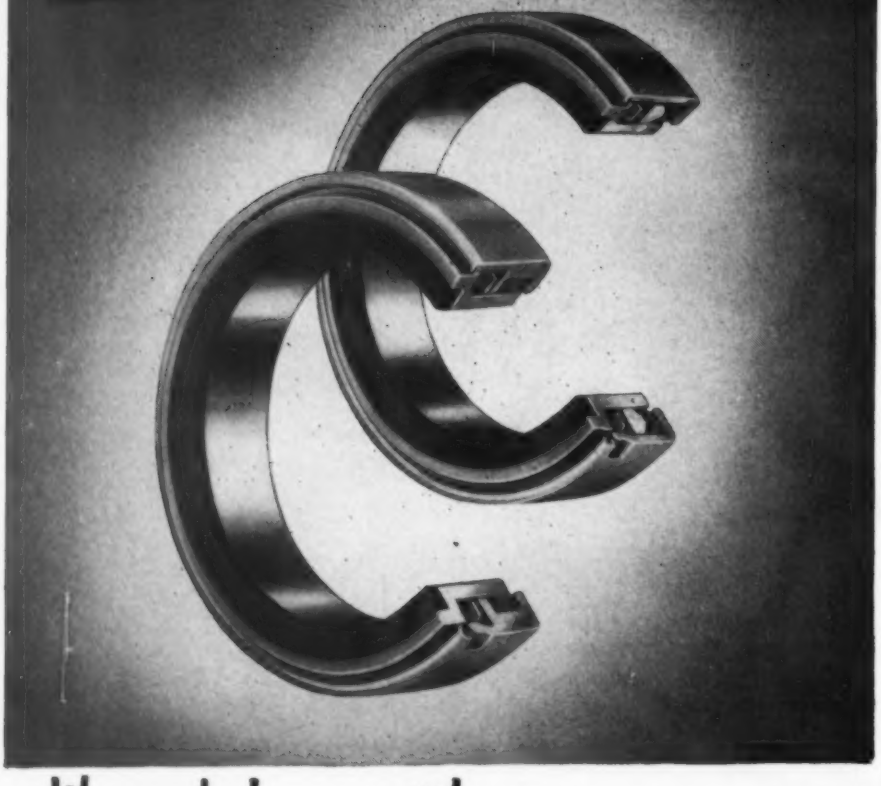
D-17

DESIGNERS...



We can help you with your shaft sealing problems

Here are a few of the advantages of Sealol Balanced Pressure Rotary Shaft Seals. They can simplify manufacturing problems and reduce manufacturing costs. They can improve product performance, increasing saleability and reducing customer complaints. They can increase product life and reduce maintenance, thereby helping to build customer goodwill.

Here's how Sealol can help the product designer. Our engineers have worked with pressures in excess of 1500 psi. We have handled surface speeds of 15,000 linear feet per minute. Our design engineers have successfully sealed fluids at temperatures as high as 600° F. Our seals are seeing service on shafts ranging from ¼" to 10" in diameter. Our production facilities are capable of turning out one-of-a-kind jobs or production runs of many thousands of units.

DESIGNERS! . . . Whether you're working on compressors or chemical pumps, dishwashers or radio direction finders, agitators or aircraft fuel pumps, Sealol has the experience, knowledge, and facilities to help you. Submit blueprints and specifications to our engineering department, for "no-obligation" recommendations. Sealol Corporation, 45 Willard Ave., Providence 5, R. I. Representatives in Chicago, Cleveland, Los Angeles, Philadelphia, Tulsa. In Canada: Lyman Tube & Bearings Ltd., Montreal, Toronto, Winnipeg.

SEALOL

The Balanced Pressure Seal

Circle 110 on Reader Service Card

Free Literature Offered in this Month's Ads

Continued

49 NEW O-RING SIZES, of various compounds, available for a wide range of service, are listed in data prepared by Precision Rubber Products Corporation.

Circle 98 on Reader Service Card

MULTI-CONTROL VALVE with a capacity of 24 gpm and a maximum pressure of 1250 psi for mobile and general industrial applications, is detailed in literature issued by Gre-Sen Manufacturing Co.

Circle 44 on Reader Service Card

AUTOMATIC AIR LINE FILTER, REGULATOR AND LUBRICATOR ASSEMBLY to protect air valves, cylinders and pneumatic tools, is described in literature prepared by M-B Products.

Circle 67 on Reader Service Card

INJECTION MOLDED O-RINGS, and other small rubber parts to meet extreme uniformity and tolerance requirements are discussed in bulletin published by Minnesota Rubber & Gasket Co.

Circle 69 on Reader Service Card

BOOST PUMPS, applicable wherever low volume output at high pressures is required, for oil or water service, are described in a bulletin issued by Sprague Engineering and Sales Corporation.

Circle 114 on Reader Service Card

FLEXIBLE COUPLINGS, which are compact in construction and maintain correct alignment between hydraulic pump and its electric motor, are illustrated in a catalog available from Lovejoy Flexible Coupling Co.

Circle 63 on Reader Service Card

HAND-FOOT-AND POWER OPERATED 4-WAY VALVES, manufactured by Ledeen Mfg. Co., are described in Bulletin 1000. Valves are built in sizes from 1/8 to 1 1/4 inches standard pipe tap, to operate air and hydraulic cylinders.

Circle 59 on Reader Service Card

POSITIVE SEAL... NO FLARING!

1
2
Line-to-line seal between tube and cutting edge of patented ERMETO sleeve.
Line-to-line seal between ERMETO sleeve and fitting body.

Bothered by Vibration? Leakage? Pressure?

THEN YOU NEED

WEATHERHEAD ERMETO®

Now you can get a positive, leakproof, vibration-resistant seal for any pressure, low to extremely high—*without flaring and using a wrench as your only tool.*

With the patented ERMETO design, the sleeve actually shears a groove into the outer surface of the tube when the nut is tightened. The result is a positive seal, for the life of the tube, regardless of how often the joint is disassembled and reassembled. Write for ERMETO Catalog E-1457.

THE WEATHERHEAD COMPANY
Department A
300 East 131st Street
Cleveland 8, Ohio

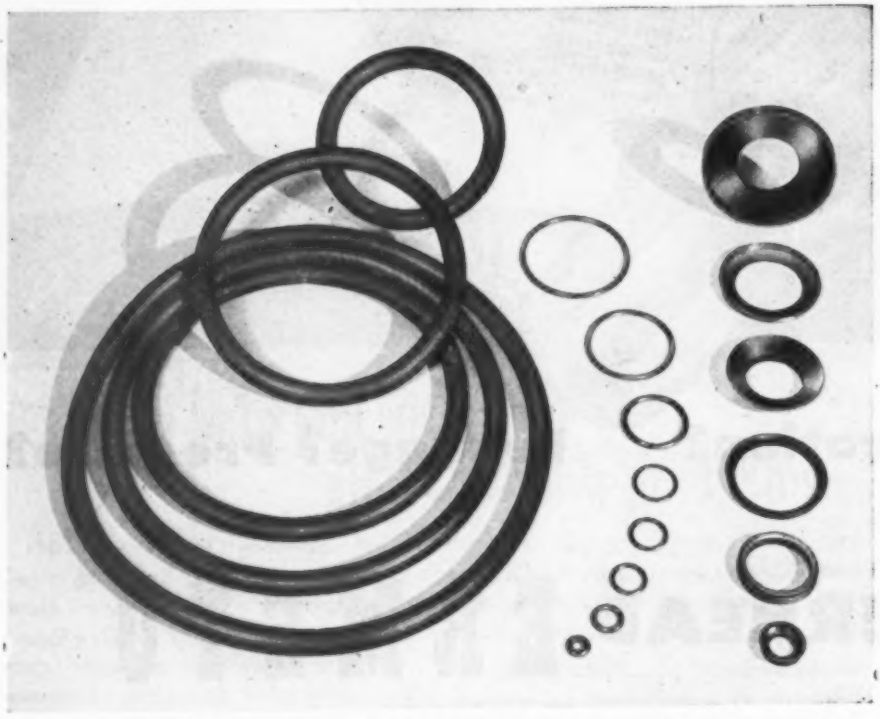
the fitting that requires
NO FLARING • No Threading
No Welding • No Soldering

The Mark of Quality
WEATHERHEAD
FIRST IN HYDRAULIC CONNECTIONS

RINGS & SEALS
SYNTHETIC RUBBER

Custom Engineered

Synthetic rubber and Silicone "O" rings, lip-type seals and cups are constantly finding new applications formerly handled by leather, asbestos, flax and many other similar materials. They have been used in many applications to replace stuffing boxes, multiple packing sets, complicated adjusting devices and other expensive machined parts.



Acushnet produces great quantities of rings and seals to exacting specifications, and has developed many compounds and exclusive methods of fabrication for this type of part. Our long experience and quality controlled production assure the highest standard of precision.

Acushnet
PROCESS COMPANY
New Bedford, Mass., U. S. A.

These items are made to order, none are stocked.

Rubber Handbook sent on request.

Address all communications to 794 Belleville Ave., New Bedford, Mass.

Free Literature Offered in this Month's Ads

Continued

QUICK CONNECTIVE FLUID LINE COUPLINGS, their features, advantages and types available, are described in catalog issued by Hansen Manufacturing Co.

Circle 47 on Reader Service Card

ACCUMULATORS, which can help to reduce size, cost and complexity of your equipment, are the subject of a bulletin offered by Greer Hydraulics, Inc.

Circle 42 on Reader Service Card

HYDRAULIC CYLINDERS which incorporate all modern design features are illustrated in Catalog No. 103, issued by the S-P Manufacturing Co.

Circle 112 on Reader Service Card

ROTARY PUMPS of the model L series, manufactured by the Tuthill Pump Company, are the subject of Catalog No. 101.

Circle 123 on Reader Service Card

SILICONE O-RINGS for use over a wide range of temperature are outlined, and engineering data given, in a catalog issued by Plastic and Rubber Products Co.

Circle 97 on Reader Service Card

CHECK VALVES of one piece construction, lightweight and low pressure drop, are described in illustrated circular A, offered by Waterman Engineering Co.

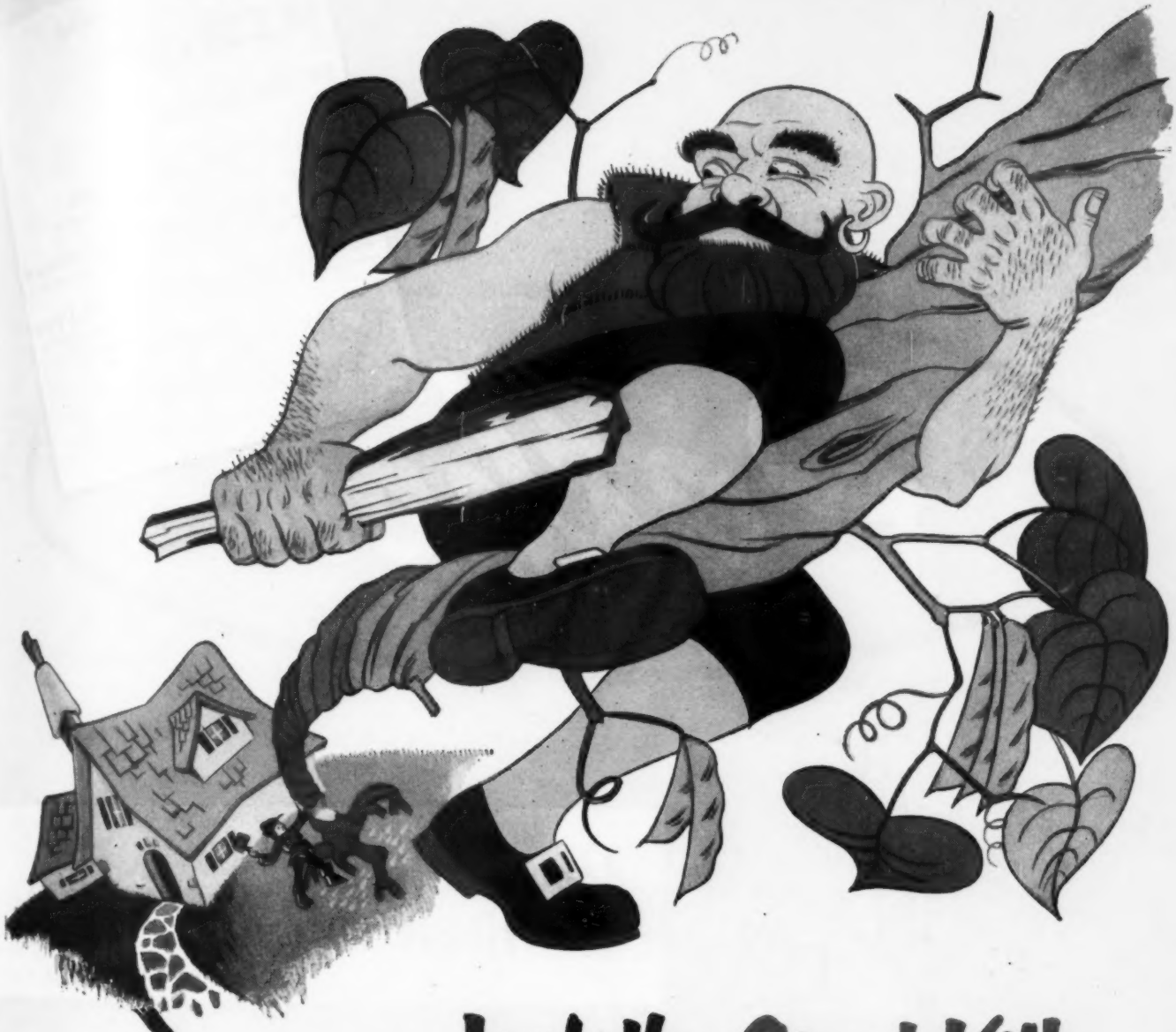
Circle 131 on Reader Service Card

REDUCING VALVE with safety relief, and an efficient air filter, combined in a single compact unit, the Airpak, is described in Bulletin FH-15, prepared by Conoflow Corporation.

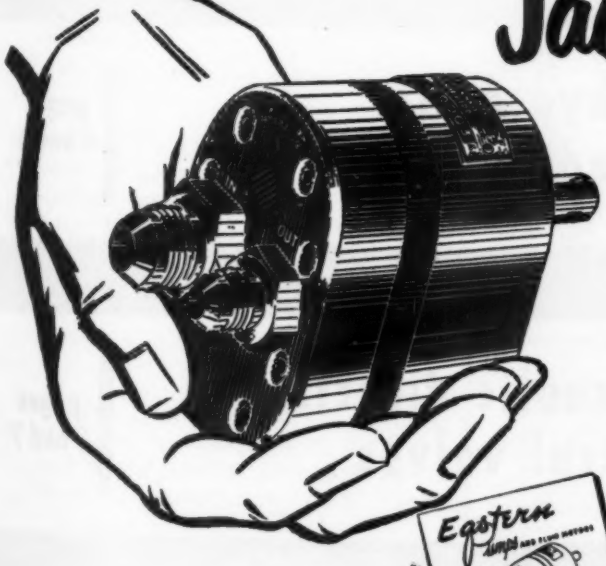
Circle 23 on Reader Service Card

TRIPLEX PUMPS for heavy duty high pressure applications, are the subject of a bulletin issued by Kobe Inc., Division of Dresser Equipment Co.

Circle 56 on Reader Service Card

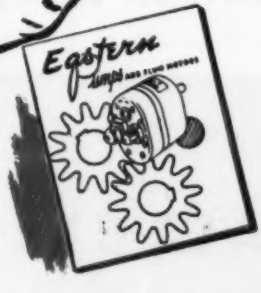


Jack the Giant Killer



Jack found the best way to slay the giant was with a sharp axe. The solution to industry's giant problem — cutting production costs — involves using a great many axes. One way to help conquer *this* giant is to substitute small equipment capable of doing a big job.

Eastern HYDRAULIC PUMPS and FLUID MOTORS are giant killers in their own right. In many installations they replace more expensive units many times as bulky. Keeping size and weight to a minimum, they help cut operating costs wherever they are applied.



EASTERN INDUSTRIES, INC.

296 ELM STREET • NEW HAVEN 6, CONN.

● *To see if one of these units might be your "hen that lays the golden eggs", write for Eastern Bulletin D-800 today.*

MEMO:

TO ALL BUYERS OF

Air Cylinders

Oil Hydraulic Cylinders

Directional Control Valves

Better get your new Pathon catalog Now!

Pathon

double acting air cylinders — pages 2 and 3

oil hydraulic cylinders — pages 4 and 5

hydraulic directional control valves — pages 6 and 7

PATHON MANUFACTURING CO.

3823 Pacific Avenue

Cincinnati 12, Ohio

Free Literature Offered in this Month's Ads

Continued

IMPREGNATED LEATHER PACKINGS and their features are the subject of engineering handbook and technical literature prepared by C. W. Marsh Company.

Circle 64 on Reader Service Card

FLOW CONTROL VALVES for handling equipment are outlined in literature offered by Benton Harbor Engineering Works. These valves automatically control load descent rates at predetermined speed.

Circle 14 on Reader Service Card

TENSION LINKAGES is the title of a booklet offered by the Chain Belt Company. The booklet gives information on tension linkage selection and application and contains detailed tables of strengths, weights and dimensions.

Circle 20 on Reader Service Card

PROTECTORS to prevent damage to threaded parts, tubing, fittings, valves, hydraulic and aircraft parts, are described in a catalog offered by Protective Closures Co. Inc.

Circle 100 on Reader Service Card

ROLLER BEARINGS for gear pumps, and their features are discussed in technical Bulletin SF-6611, issued by Roller Bearing Company of America.

Circle 107 on Reader Service Card

SYNTHETIC RUBBER RINGS AND SEALS which can be used in many applications to replace stuffing boxes and multiple packing sets, are outlined in a Rubber Handbook published by Acushnet Process Company.

Circle 2 on Reader Service Card

HYDRAULIC CYLINDERS of the RH series, manufactured by the Pathon Manufacturing Company, are featured in Bulletin No. 17.

Circle 92 on Reader Service Card

PIPE PLUGS which will withstand up to 3000 psi pressure without leaking are featured in folder AP, offered by Allen Manufacturing Co.

Circle 5 on Reader Service Card

FULL FLOW fittings...

designed to stop hose pull-outs, too!

... provided by Resistoflex medium-high pressure hydraulic hose assemblies

That's right – fitting bore matches hose I.D. on these hydraulic lines – eliminates flow restrictions in J.I.C. fittings.

When fitting is crimped, the hose's high tensile compar tube forms no obstructing bulge; and the fitting is on for *good* with a grip exceeding tensile strength of the hose itself.

Completely oilproof, the compar tube won't gum and clog hydraulic systems. Its extra strength, plus that of high strength synthetic-fiber braid, eliminates need for wire braid in medium-high pressure hydraulic circuits. With this non-metallic construction you get *more hose value per dollar* other ways, too:

1. High burst strengths – stay high even as working age increases.
2. High pull strength – more than 3500 lbs for ½" hose. What's more, couplings won't pull out even under this tension.
3. Long impulse life – virtually unlimited fatigue resistance to shock loads and impulses. Hose lasts longer.
4. High impact strength – hose returns to original cross section after crushing load.

I.D. (inches)	Working Pressure (psi)	Min. Burst Pressure (psi)	Assembly Tensile Strength (lbs.)
¼	2300	9200	900
⅜	2050	8200	2500
½	1800	7200	3500

Write for Bulletin MH-1

HOW YOU BENEFIT WITH "FLUOROFLEX-T" BACK UP RINGS—Made from "Teflon" resin, these anti-extrusion rings for "O" rings: (1) Resist heat; (2) Reduce friction; (3) Don't fray, swell, shrink, harden or soften in synthetic or natural oils; (4) Permit easier installation; (5) Increase life of the assembly. Write for Bulletin FR-1.

RESISTOFLEX CORPORATION

Belleville 9, New Jersey

SPECIALLY ENGINEERED FLEXIBLE RESISTANT PRODUCTS FOR INDUSTRY

← Circle 93 on Reader Service Card

Circle 16 on Reader Service Card

NO RUST, NO SLUDGE, NO FOAM—that's what we mean when we say that *Texaco Regal Oil (R&O)* keeps hydraulic systems clean. And that's the kind of cleanliness that means smoother operation, freedom from unscheduled stoppages, longer life for pumps, lower maintenance costs.

Texaco Regal Oil (R&O) is turbine-quality oil that tests prove has *more than ten times the oxidation resistance* of ordinary turbine-quality hydraulic oil – plus improved rust-preventive properties. It is specially processed to prevent foaming.

There is a complete line of *Texaco Regal Oils (R&O)* to meet the requirements of every type and size of hydraulic mechanism. A Texaco Lubrication Engineer will gladly help you select the proper one to improve the performance of your equipment.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R & O)

FOR ALL HYDRAULIC UNITS

TUNE IN: Tuesday nights on television—the TEXACO STAR THEATER starring MILTON BERLE. See newspaper for time and station.

at high cycling speeds Boyle's Law does not hold. Temperature variation requires another method for . . .

Accumulator Selection . . . "The Rule of Three"

By J. Russell Hemeon

LAST October, APPLIED HYDRAULICS published a Data Sheet showing how Boyle's Law is applied to the selection of bladder type accumulators. This Data Sheet opened a subject which has been controversial for a long time.

The example worked out in the Data Sheet was based on a demand volume $V_3 - V_2 = \Delta V = 251$ cubic inches to be delivered in 1-2/3 seconds from a P_2 of 3,000 psi. The answer selected a 5 gallon accumulator. From our experience, the accumulator would be too small, and with P_3 at 3,000, would involve excess bladder stress with short life before a ruptured bladder. There would also be an accelerated rate of nitrogen osmosis leak and frequent recharge to maintain P_1. From our experience, the accumulator for this installation should be of 15 gallons capacity minimum with a safety preference for two 10 gallon accumulators.

This article is the result of a request to explain the method which we use to select a satisfactory and economic accumulator size for high speed industrial applications. Have you ever watched a nitrogen pressure gage on a high speed accumulator actuated system? If so, you will have found that the terminal pressure P_3 at the end of the work stroke is much lower than what would be computed by using Boyles Law. After a complete investigation, it was found that the following major factors must be compensated for:

A. The high speed expansion of nitrogen chills the gas for a low terminal pressure.

B. High speed operation with extreme Reynolds number evaluation partially voids oil in the system tubing. This void must be replaced in the subsequent reverse flow phase.

Development results over the past years on several different types of accumulator powered installations have shown that it is impossible to obtain satisfactory results on high speed installations by the use of Boyle's Law, Charles' Law, or any broad exponential formula. We have developed "THE RULE OF THREE" which has materially reduced—

1. **Excess replacement of stress ruptured bladders.**
2. **Too frequent recharging with nitrogen.**
3. **Ineffective terminal pressure.**

In order to understand "THE RULE OF THREE", you should study the data shown in Figures 1, 2 and 3.

Figure 1 shows the three conditions of nitrogen, oil, and separator bag or bladder in the type of accumulator under consideration. The notes under the accumulator sections should be studied and understood before proceeding. Figure 2 serves as a good introduction to the effect of temperature on nitrogen pressure. The accumulator has been blown down for a cold check on the nitrogen pre-charge pressure.

In Figure 2, the low initial reading $PIC_{(i)} = 475$ psi (Nitrogen precharge pressure, C = cold and (i) = instantaneous) is not the true precharge pressure. The

J. RUSSELL HEMEON, Hydraulic Equipment Engineer, Ternstedt Division, General Motors Corporation, Trenton, New Jersey.

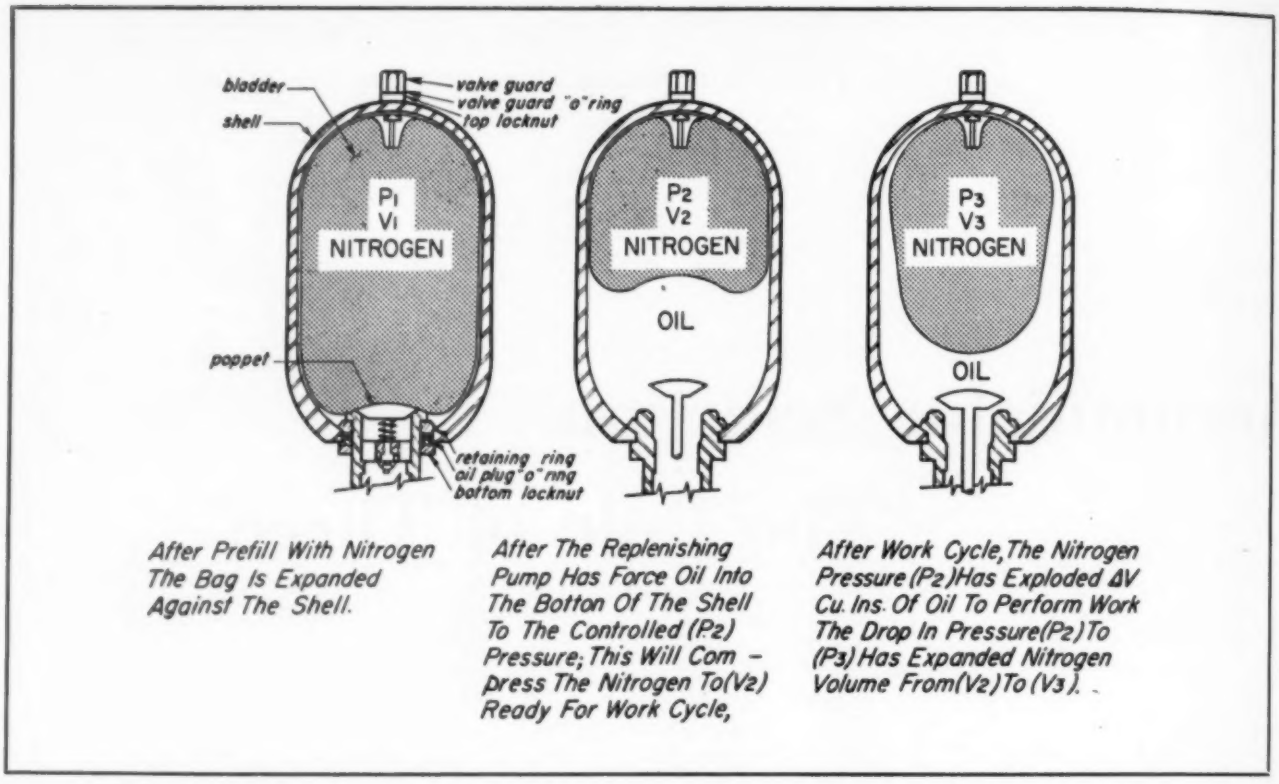

bladder
shell
valve guard
valve guard "o" ring
top locknut
P1
V1
NITROGEN
poppet
retaining ring
oil plug "o" ring
bottom locknut
P2
V2
NITROGEN
OIL
P3
V3
NITROGEN
OIL
After Prefill With Nitrogen The Bag Is Expanded Against The Shell.
After The Replenishing Pump Has Force Oil Into The Botton Of The Shell To The Controlled (P2) Pressure; This Will Com - press The Nitrogen To(V2) Ready For Work Cycle,
After Work Cycle, The Nitrogen Pressure (P2) Has Exploded ΔV Cu. Ins. Of Oil To Perform Work The Drop In Pressure(P2) To (P3) Has Expanded Nitrogen Volume From(V2) To (V3).

FIG. 1. Accumulator sections showing the three conditions of nitrogen, oil and separator bag.

nitrogen had been chilled by expansion. As the warmer steel shell at room temperature transfers heat through the bladder to the cold nitrogen; the nitrogen pressure rises as shown on the graph and gradually stabilizes after two minutes at a true reading $PIC_{(s)} = 495$ psi (True precharge pressure, C = Cold 72°F. and (s) = Stabilized).

Figure 3 shows the (i) instantaneous pressure and low temperature, when the rate of discharge of 190 cubic inches of oil was varied in steps from 63 seconds to 15 seconds. It is to be noted that in every case, the nitrogen precharge pressure finally stabilized at a true $PIC_{(s)}$ of 480 psi. At the slow 63 second venting speed, the low instantaneous nitrogen pressure was 460 psi, with a corresponding temperature of 49°F. At the fast 15 second venting speed, the low instantaneous pressure was 435 psi with a corresponding temperature of 21°F.

A well designed high speed accumulator powered system has oversize valves and long radius bend tubing to insure fast action, with a minimum of pressure drop losses. Production actuations are being accomplished in micro-seconds. So that instead of expanding the nitrogen in 15 seconds as shown on the fast line on Figure 2, we are dealing with a 0.1 or 0.2 second explosive discharge of one third of the oil volume. If the entire amount of the available oil were discharged, the terminal temperature would be considerably below 0°F. and the terminal pressure and force would be materially reduced below the Boyle's Law determination.

With further reference to factor B, it is suggested that you disconnect the tubing from the "T" port of the four-way control valve and catch the exhausted oil in a well braced bucket. You will be surprised to learn that the bucket contains more cubic inches of oil than you have volumetrically computed to be in the exhausting side of the actuating cylinder. So now when you make an accumulator shot into the partially voided tubing, you must first fill the partial void before you can obtain effective working results. Hence the "Demand Oil" volume is always greater than the bore × stroke computed volume. Recent voiding control developments have reduced this partial voiding.

The space limitations of this article preclude delving into all the experimental and theoretical work which has been carried on in the past five years. The purpose of this article is to present step computations, using the practical "RULE OF THREE" to help you select that accumulator size which will result in better performance with a decrease in maintenance cost.

"The Rule of Three"

If you desire a quick solution for the economic size of a bladder type accumulator, here is the simple rule. Compute ΔV, the total cubic inches of demand oil. Example:—3 cylinders with a 2 inch bore by 2⅛ inch stroke have a demand volume of 20 cubic inches.

MULTIPLY ΔV BY 3 × 3 × 3 = 27 ΔV.
In this case 27 ΔV = 27 × 20 = 540 cubic inches
Hence, specify a 2½ gallon accumulator with a V_1 of 550.

If you have an analytical mind and desire a step procedure, you will find the following description informative.

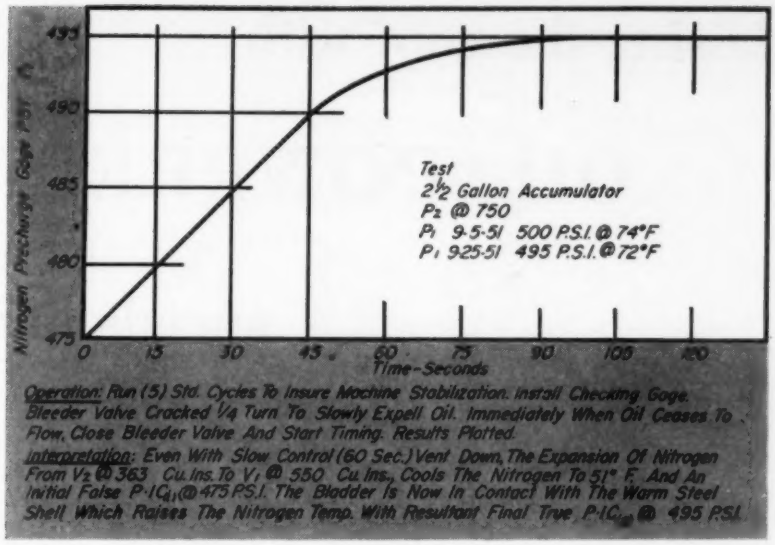

Nitrogen Precharge Gage P.S.I.
495
490
485
480
475
0
15
30
45
60
75
90
105
120
Time-Seconds
Test
2½ Gallon Accumulator
P2 @ 750
P1 9-5-51 500 P.S.I. @ 74°F
P1 9-25-51 495 P.S.I. @ 72°F
Operation: Run (5) Std. Cycles To Insure Machine Stabilization. Install Checking Gage. Bleeder Valve Cracked ¼ Turn To Slowly Expell Oil. Immediately When Oil Ceases To Flow, Close Bleeder Valve And Start Timing. Results Plotted.
Interpretation: Even With Slow Control (60 Sec.) Vent Down, The Expansion Of Nitrogen From V2 @ 363 Cu. Ins. To V1 @ 550 Cu. Ins., Cools The Nitrogen To 51° F. And An Initial False P·IC1 @ 475 P.S.I. The Bladder Is Now In Contact With The Warm Steel Shell Which Raises The Nitrogen Temp. With Resultant Final True P·IC2 @ 495 P.S.I.

FIG. 2. Shows the time of recovery of nitrogen pressure P_1 after the working oil in the accumulator has been discharged.

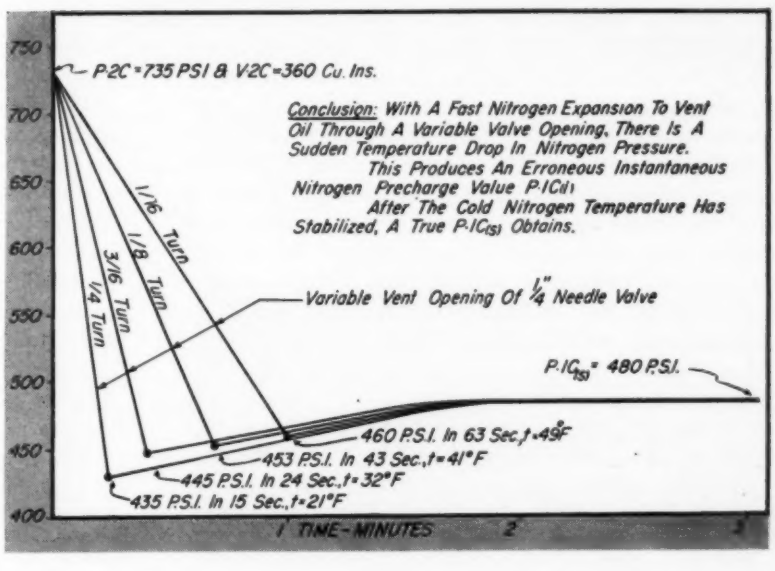

750
700
650
600
550
500
450
400
P.2C = 735 PSI & V.2C = 360 Cu. Ins.
Conclusion: With A Fast Nitrogen Expansion To Vent Oil Through A Variable Valve Opening, There Is A Sudden Temperature Drop In Nitrogen Pressure. This Produces An Erroneous Instantaneous Nitrogen Precharge Value P.IC(1) After The Cold Nitrogen Temperature Has Stabilized, A True P.IC(S) Obtains.
1/16 Turn
1/8 Turn
3/16 Turn
1/4 Turn
Variable Vent Opening Of ¼" Needle Valve
P.IC(S) = 480 P.S.I.
460 P.S.I. In 63 Sec., t = 49°F
453 P.S.I. In 43 Sec., t = 41°F
445 P.S.I. In 24 Sec., t = 32°F
435 P.S.I. In 15 Sec., t = 21°F
1 TIME-MINUTES 2 3

FIG. 3. Shows instanteous pressure and low temperature when the rate of discharge was varied in steps. In each case nitrogen precharge pressure finally stabilized at the same pressure.

Step 1—Compute the theoretical ΔV Demand Oil.
Example—$3.14 \times 2.12 \times 3 = 20$ *cu ins*

Step 2—There must be enough oil in the bottom of the accumulator at condition 2 to make a total of three power strokes without a pump refill. This first 3 is for a low bladder stress and good performance.
Therefore, multiply Step 1 by 3.
Example—$20 \times 3 = 60$ *cu ins*

Step 3—For the reasons as given under factors A and B, there is a factor K which was termed the "factor of ignorance." In the early days, this was 4.5. By experience, protected design and limitations it has been possible to now make this the "factor of knowledge" at 1.5.
For average considered design, we recommend $K = 3$.
Therefore, multiply Step 2 by K.
Example—$60 \times 3 = 180$ *cu ins*

Step 4—At the start of the work stroke (Condition 2), optimum performance is realized by having the oil volume at one third of the total accumulator volume.
Therefore, multiply Step 3 by 3.
Example—$180 \times 3 = 540$ *cu ins*

For the example which has been worked out at 540 cu ins, a 2½ gallon accumulator is just right.

It is now in order to make a listing of the known and unknown factors and progressively solve for the unknowns.

$P_1 = ?$ and $V_1 = 550$ cu ins
$P_2 = ?$ and $V_2 = 0.67V_1$ or 367 cu ins
$P_3 = ?$ and $V_3 = V_2$ plus $K\Delta V$ or 427 cu ins
$\Delta V = 20$ cu ins and $K\Delta V = 60$ cu ins

Solve for unknown P_3

Let it be assumed that a pressure force of one ton (2,000 lbs.) is desired at the end of the work stroke. We are using a 2 inch bore cylinder in the example.
$P_3 = 2{,}000$ divide $3.14 = 637$ *psi*
Increase P_3 to 650 for a round number.

Solve for unknown P_2

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Raising the roof with

OIL POWERED JACKS

speeds building construction

"SIDEWALK superintendents" in many parts of the country have had a chance to watch one of the most dramatic new construction techniques raise a concrete roof slab from the ground where it was cast to its "roof position." This lift-slab method which uses a group of simple hydraulic jacks, controlled from a panel that rides up with the roof slab, is saving contractors time and money. The technique fits in well with modern trends in architectural design because it permits the use of large window areas and other wall materials which cannot support loads.

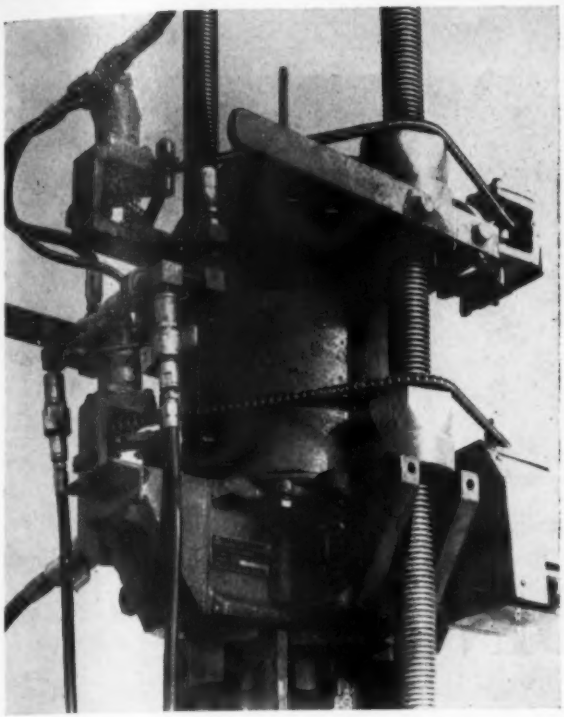
Last month, out in one of Cleveland's growing suburban developments, we stood on a concrete slab which was being raised to become the roof of a bank building. It took the Ohio Lift-Slab Corporation less than a day to lift the slab. Earl Craft, the foreman on the job, described the method and operation of the hydraulic system.

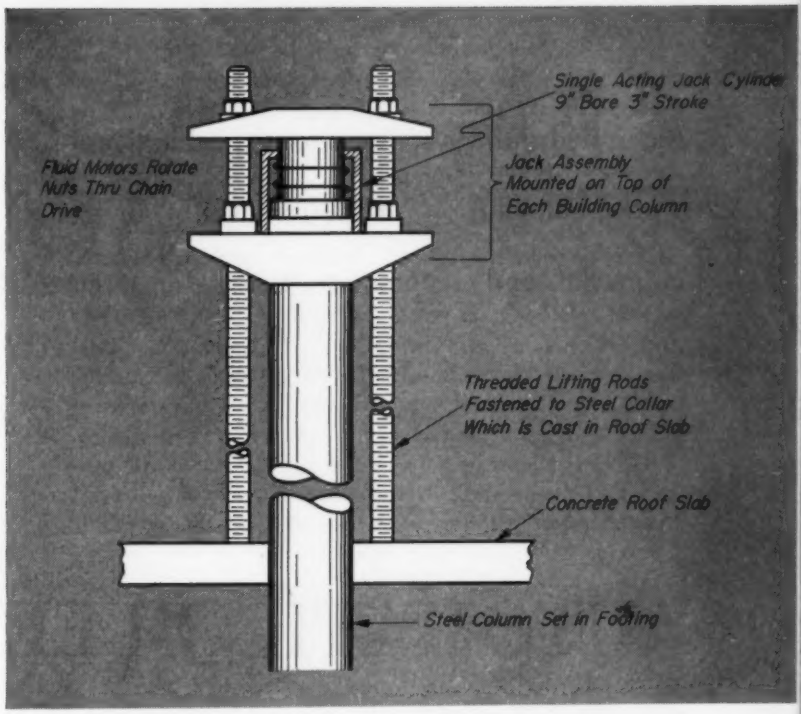
The method is simple. It is being used for buildings having one of several stories. Steel building columns are fastened in their footings and then reinforced concrete slabs are poured and cured on the ground, one on top of the other. Holding collars to fasten the jack rods at each column, are cast in the roof slab. Hydraulic jacks, one on top of each building column, raise the roof and upper floor slabs up the steel building columns to the upper height. With the slab in its final position, support plates are welded to each column directly below the slab; the jacks are removed and the job is done.

The hydraulic system is designed to handle 12 jacks. If the slab design uses fewer columns, jack circuits

HYDRAULIC JACKS, ONE ON TOP OF EACH of 12 columns, are raising this million pound roof. Roof slab was cast at ground level and when fully raised the lift totalled 20 feet at the rear set of six columns and 24 feet at four front columns. This lift and tilt is controlled hydraulically.

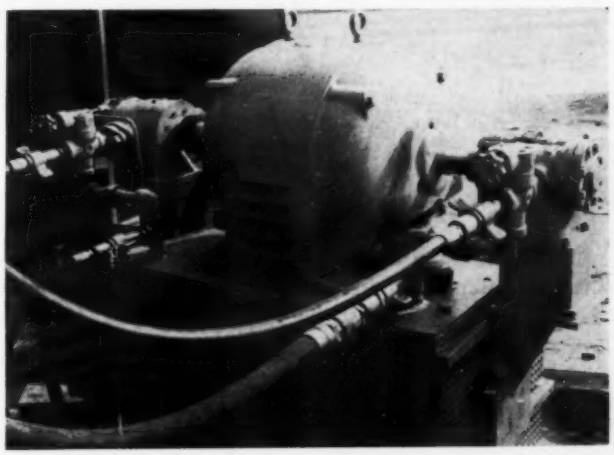
Courtesy Vagtborg Lift-Slab Corporation





EACH JACK ASSEMBLY rests on top of a column. As the single acting cylinder moves up, the slab is raised and the lower fluid motor, seen in the photo of the jack assembly, rotates the lower nuts to keep the nuts in contact with the bottom cross member. When pressure on the jack is released, the ram is spring returned and the upper fluid motors rotates the upper nuts keeping them in contact with one cross-member. This stroking is repeated until the slab is fully raised.

ON GROUND LEVEL this power package pumps oil to the console on the roof. One 1000 psi pump supplies the fluid motors. A two stage, 2000 psi pump powers the jacks.



AS THE ROOF goes up, this operator and console goes with it. Each jack can be individually controlled. Top knobs operate shut off valves. Center valves are for speed control. Counter dials indicate amount of lift at each cylinder. Movement of the 3-way valve handle controls the jacks.

are cut out. If more columns are required, a supplementary hydraulic system is used.

Each jack is a single acting, spring returned, 9 inch diameter, 3 inch stroke cylinder. The accompanying photograph and sketch illustrate the construction and operation of the jack. Oil pressure hose lines to each jack come from the control console which is on the slab and moves with it. At this console, the operator has complete control over each jack. He can operate them singly, all at once, or in any combination. Flow control valves permit speed regulation, and a two position 3-way valve operates the jack cylinder.

Two long threaded rods, at each jack, move up as the slab is hoisted. Nuts and spacer blocks carry the load. Two small piston type fluid motors are seen in the photograph of the jack. These fluid motors, con-

Continued on page 128

Air in hydraulic systems causes trouble. Here is a practical solution for the removal of air from industrial and automotive hydraulic circuits

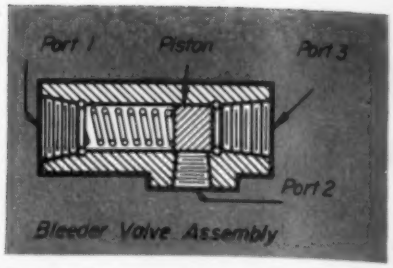


Fig. 1. Cross-section of bleeder valve.

AUTOMATIC BLEEDING of Air in Hydraulic Systems

By Milton Adler

PROPER operation of a hydraulic system is not possible with quantities of air entrained in the oil. Transmission of undiminished pressure in a hydraulic system is possible because oil is incompressible. This is not true when the system contains air, because air alters this incompressibility feature of the circuit.

Air that enters a hydraulic system is soluble in oil. The degree of solubility depends on the oil pressure. For example at 77 F and at atmospheric pressure, approximately 23 cu in of air can be dissolved in a gallon of oil. At 200 psi gage pressure, at the same temperature, approximately 322 cu in of air can be dissolved in a gallon of oil.

As long as the oil is under pressure, the air remains in solution and does not impair the compressibility of the oil, but when the pressure is released, the air is released as bubbles which cause foaming in the various hydraulic components. Oil containing this free air and foam is no longer incompressible and causes irregular action of valves and pistons. It also causes noise and erratic machine operation.

In addition, the air can seriously affect the performance and durability of the oil. For example, when air is drawn into the suction side of a pump, it is compressed from atmospheric pressure to oil discharge pressure which may be several thousand pounds per square inch. As the oil pressure increases, the amount of air which can go into solution in the oil is also increased. There is a tendency, therefore, for the air to be absorbed by the oil and to disappear. Whether all of the air is absorbed, or whether part remains to be compressed, depends upon the speed with which the pressure is applied and the size of the air bubbles. Small bubbles, with a high ratio of surface to total air volume, pass quickly into solution in the oil. Larger bubbles are more difficult to absorb, and so remain in the oil as compressed air. Air which is compressed quickly becomes very hot. The higher the pressure the hotter the air. For example, the temperature of compression at 200 psi is 672 F, while at 1000 psi the temperature is 1300 F. The compressed air remains very hot even though it is surrounded by oil which has a cooling effect upon it. The oil around the hot bubbles will be scorched and oxidized. Continued oxidation of this sort is cumulative, and will eventually make itself evident throughout the entire volume of oil.

The slightest deficiency in operation of a hydraulic system in machine tools may result in lost production and impaired finishes. The causes of poor machine operations are usually traced to air which has entered the system.

In vehicles, air will nullify the effective stroke of the brake pedal, and in aircraft, air will actually cause

MILTON ADLER, Mechanical Engineer, New York City

flutter of the controlled surfaces, cause erratic operation of the entire system, and contribute unnecessary noise and vibration.

Here is how air will normally enter a hydraulic system:

When the circuit is first installed.
When any part of the circuit has been disconnected.
When the pump is defective.
When the fluid gets too low in the reservoir.
When the fluid gets too hot and boils.
When pin holes are present in the lines or packing glands.
When the oil is allowed to cascade in the reservoir.

Bleeding of air in a hydraulic system is imperative, and in most installations is presently accomplished manually. This is done either as a routine preventive maintenance procedure at regular intervals, or after trouble has been noticed in the operation of the system.

Benefits of Automatic Bleeding

Since it is practically impossible to prevent completely the entrance of air into the hydraulic system, this bleeding operation must be a constant and vigilant procedure. Failure to do so results in lost production and malfunctioning of the equipment. This manual bleeding is a rather long and tedious process, especially in complicated circuits or where the air has already caused malfunctioning. The bleeding operations aggregate many man-hours of labor and lost machining time during any one year. It seems inevitable, therefore, that the economic pressure for greater production at lower cost, saving of maintenance man-hours, and desire to reduce machine break downs would result in the development of an automatic hydraulic bleeding system which would automatically remove any air in the system without the requirement of manual control.

Such a bleeding system on which patents are pending, has been developed. The development program started with a thorough study of the effects of air in the hydraulic system, methods and procedures currently recommended for manual bleeding operations, and the design of a system which would duplicate the manual bleeding operation automatically at all times while the system was in regular operation. A further object of the development program was to evolve a system which could be easily and cheaply incorporated in present hydraulic installations with the minimum amount of alteration to the existing system.

The design that was successfully developed can be used on all industrial hydraulic circuits, automotive brake systems, and aircraft and vehicle hydraulic circuits.

A description of the automatic bleeder for hydraulic brakes will be given first, due to the simplicity of the hydraulic circuit as compared to industrial hydraulic circuits. The theory and basic operations, however, is the same in all hydraulic systems.

The conventional hydraulic brake system is shown in Figure 2. In the braking operations, the fluid moves in the connecting tubing from the master cylinder to the wheel cylinders. When the brakes are released, the fluid moves back from the wheel cylinders to the master cylinder in the same tubing. Any air that enters the system, therefore, is trapped along the line, because the fluid is merely reciprocating back and forth in the same line. In order to bleed the brakes, it is necessary to have the fluid flow in one direction only, thus carrying the air bubbles with the flow, and discharging them into the outside air. This is what is performed in the conventional manual bleeding operation. This is accomplished by opening the bleeder valve in each of the wheel cylinders and pumping fluid out of the system until no bubbles appear, while

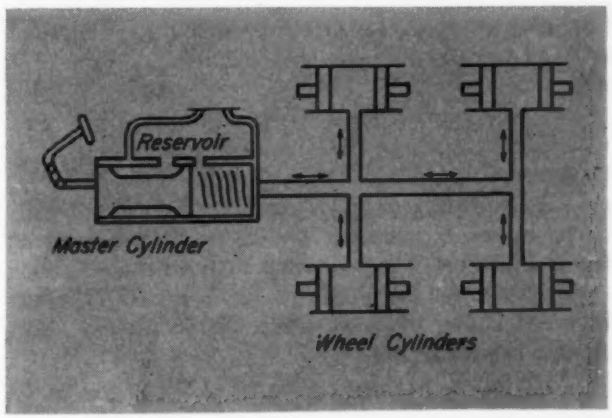
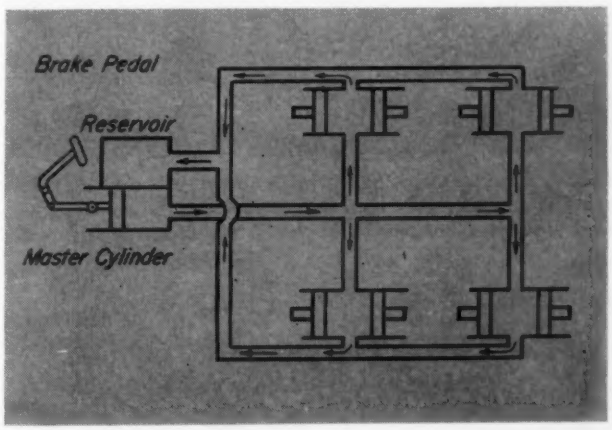


Fig. 2. Conventional brake system using one line traps air because fluid is reciprocated back and forth in the line.

Fig. 3. Schematic of "one direction flow" brake system shows a separate return line which serves to discharge air into the reservoir.



clear fluid is replaced in the reservoir. The bleed valves are then closed.

The theory of operation of the self-bleeding brake system is to provide a system having a "one direction flow." The fluid flows from the master cylinder to the wheel cylinder on the pressure stroke. When the brakes are released, the fluid continues its circular path, and returns directly to the reservoir through a separate

Automatic Bleeding

tubing, discharging any air into the reservoir, which escapes to the outside atmosphere. This path of the fluid is the same as is followed in the manual bleeding operation, and does not allow any air to remain trapped in the system, but is immediately removed, due to the one direction flow. Figure 3 is a schematic diagram showing this continuous flow.

It is necessary to provide means for closing the return line from the wheel cylinder to the master cylinder on the pressure stroke, so that the fluid pressure can be transmitted to the wheel cylinder without escaping back to the reservoir. Similarly, the pressure line must be closed on the return stroke, so that the fluid will be forced to move through the return line to the reservoir, and not back up along the pressure line.

This is accomplished by inserting the bleeding valve (Figure 1) in the return line, and a check valve in the pressure line. The bleeder valve consists of a body, piston, spring and retainer ring. Port 2 returning to the reservoir is normally closed by the pressure of the spring. Port 3 is connected to the wheel cylinder and port 1 to the discharge side of the master cylinder. Figure 4 shows the installation of the bleeder valve and the check valve.

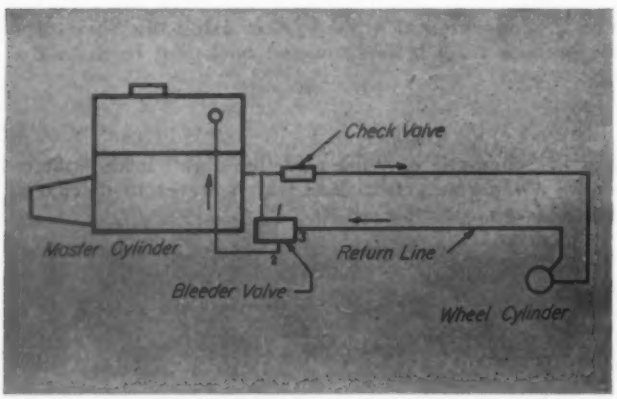
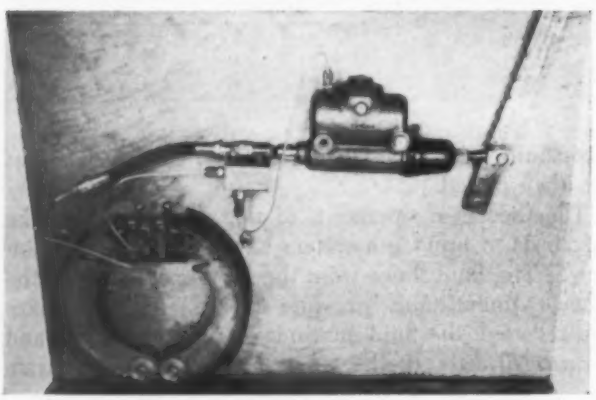


Fig. 4. Bleeder valve installed in the return and a check valve in the pressure line operate to maintain one direction flow and automatically bleed air from the system.

Fig. 5. Mock up of self bleeding brake system.



When the brake pedal is depressed, the fluid flows to the wheel cylinder. At the same time, fluid flows through port 1 to the bleeder valve. This pressure balances the pressure at port 3 from the wheel cylinder and prevents the piston from uncovering port 2. When the pedal is released, the check valve in the pressure line closes, preventing the fluid in the wheel cylinder from returning along this line. At the same time, the pressure in port 1 has been removed, and the fluid in port 3 will push the piston against the spring pressure, uncovering port 2 and flowing back to the reservoir,

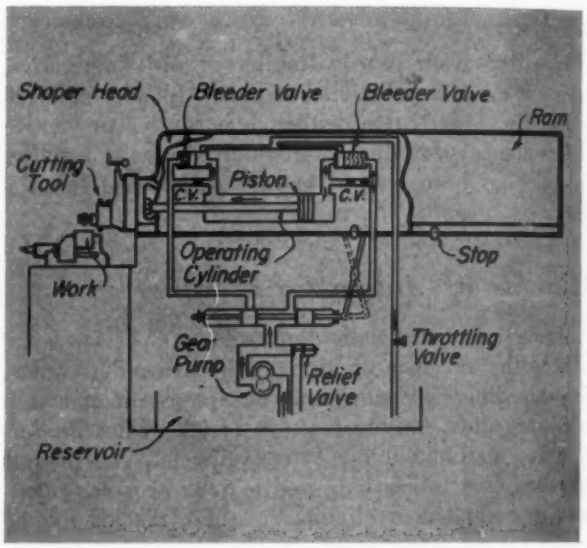


Fig. 6. Application of automatic bleeding valves in a shaper.

thus completing its circular path from the master cylinder. The valve spring is calibrated to close at any desired pressure, usually 10-12 psi, so as to maintain a certain residual pressure in the brake lines. The fluid in returning to the reservoir carries with it any entrapped air which is deposited in the reservoir and escapes through the air vent.

This automatic bleeding valve could be incorporated in new designs of master cylinders, or could be installed as a separate unit on existing vehicles. In addition, the return tubing from the wheel cylinders would parallel the existing pressure tubing.

The method of using the automatic bleeding valve in industrial applications is basically the same as on the brakes. Figure 6 shows a typical installation in a shaper. This simple conventional hydraulic system consists of a reservoir, pump, reversing valve, actuating cylinder and connecting tubing. The fluid flowing to the operating cylinder is returned to the reservoir in the same line. This reciprocating action does not allow for the escape of entrapped air.

In the automatic bleeding system, however, the fluid is pumped to a reversing or selector valve which directs the fluid to one side of the actuating cylinder. Next to the actuating cylinder port is located the automatic bleeding valve. This valve is the same as de-

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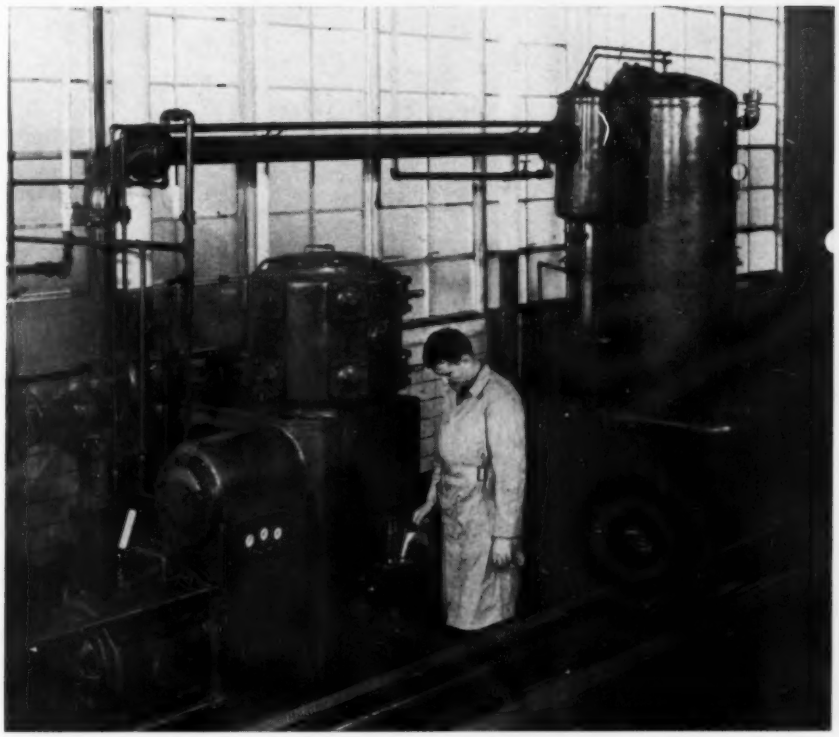

NEW 800 cfm compressor installation supplies the air demands of shop equipment in Monarch Machine Tool Company's enlarged plant.

Planning Expanded Production?

You'll Need Greater Compressed Air Capacity

Industry's plans for capital spending are still on a big scale. Depreciation allowances for manufacturers now total about $6 billion a year. This money is going into plant and equipment. While a good part of the new equipment is for replacement and modernization, much of the capital additions are for expansion to shove manufacturing output higher. Here's the story of how a machine tool builder modernized and increased the capacity of its air compressor installation to meet the demands of its enlarged plant.

LAST year, The Monarch Machine Tool Co., Sidney, Ohio, completed a plant expansion that had started shortly after the outbreak of hostilities in Korea. In adding the 43 per cent more floor space to bring the present plant area to 308,000 square feet, all building services have been re-evaluated in terms of growing production and anticipated growth.

The old air compressor installation included one 13½ and 8 x 8 inch stroke two stage unit powered by a 100 hp motor and a 12 x 10 inch single stage unit driven by a 60 hp motor. These units at full capacity provided about 800 cfm. Having seen many hours of service, full time operation around the clock during the past war, they were getting old and the plant demands were pushing them to near capacity.

A completely new air compressor installation was made about 360 feet away from the old compressor room to keep from disturbing the old installation while the new one was being made and also to disperse this utility to some degree. Old and new systems are tied together at all times and one unit can be shut down and the other started, at any time, without affecting the air supply.

Management's original idea was to invest in the new unit and sell the smaller of the two older units, using the larger of the older units as a standby to the new compressor. As conditions now stand increased air usage has resulted in keeping both old units as standbys. The larger unit was given an extensive overhaul and is now in first class shape.

The new installation has a two stage crosshead type, air compressor built to deliver 800 cfm at 100 psi. This 14½ and 9 x 7 inch stroke compressor is

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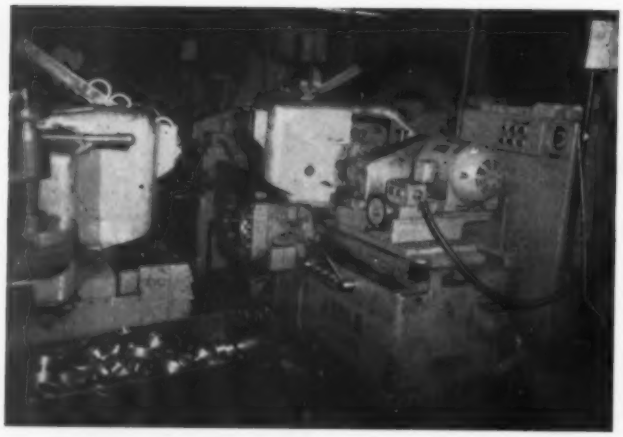
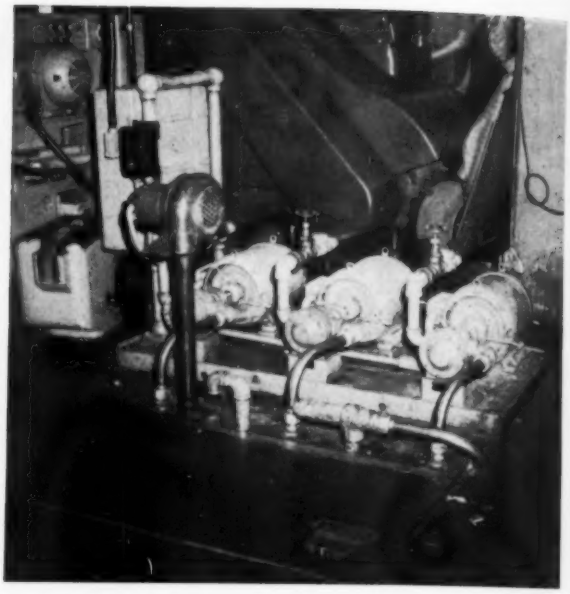




HYDRAULIC OIL for twelve internal grinders in a battery is supplied by a single power unit having three pumps feeding into a common line. Isolating the power unit removes a source of vibration. The air pump vents moisture from the tank.

When Bower Roller Bearing revamped their grinding department, they found that a . . .

CENTRAL POWER SOURCE can cut maintenance costs

IF you are planning to install a number of similar hydraulically powered machines in your plant, it will pay you to consider the advantages of grouping these machines as a battery and using one power source in place of individual pumps and motors at each machine. Where a battery is practical, you should be able to realize important savings in maintenance and operation. You might also save a little on the initial investment.

When Bower Roller Bearing Company in Detroit revamped and made additions to their grinding machines and furnaces they grouped their equipment to use central power units.

Today, they have a large number of Heald Model 180 centerless internal grinders arranged in batteries of six machines each. Each of two such batteries is connected to a separate power source as shown in the machine layout drawing. The power source is a three pump unit; each pump having a capacity of 18 gpm and is driven by a 3 hp motor. Operating pressure is approximately 250 psi.

Eliminates Source of Vibration

The grinders can be adapted very readily to a single power source. This is not true of all machines. Because grinding is a high quality close tolerance operation, any arrangement which will reduce the possibility of vibration will pay dividends in improved production and lower rejects. Isolating the pump from the ma-

. . . while it's not desirable to power all types of machines from one power source, on this centerless grinder installation operating and maintenance costs have been reduced

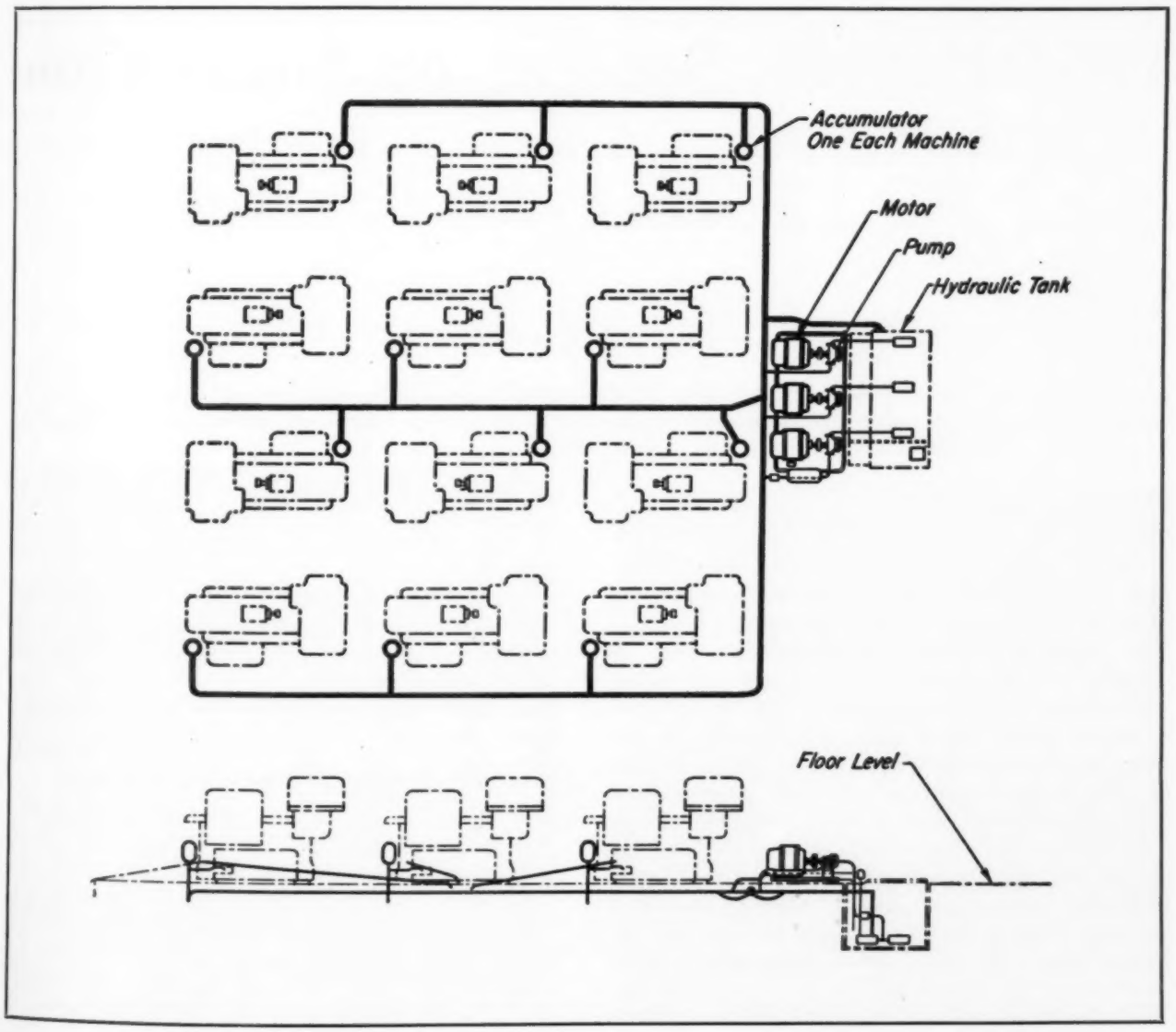
chines and running hydraulic lines in the floor removes a source of vibration.

Of course, you can't arrange all sizes of grinders in batteries and get the same benefits that Bower is getting with the Model 180. Some other models would require such large power units and oil reservoir that the central system would not pay. You'll have to consider the machine's oil requirements and layout.

Bower has also powered the tilting and dumping mechanisms on a group of four rotating retort furnaces from a single pump power source. This is possible because the cycle of tilting is not important; therefore, if two cycles should occur simultaneously, the completion of one cycle just prior to the other, as required by pump capacity, is not objectionable.

Bower has found that the major gains of battery operation are lower operating costs and reduced maintenance. Where it's good production practice to group machines, it is smart planning to consider a single power source.

SUGGESTED LAYOUT of 12 grinders powered by a central power source. Hydraulic lines run below floor level. An accumulator at each machine maintains a constant power source to prevent any feed variations which might be caused by varying demands on the pumping unit.



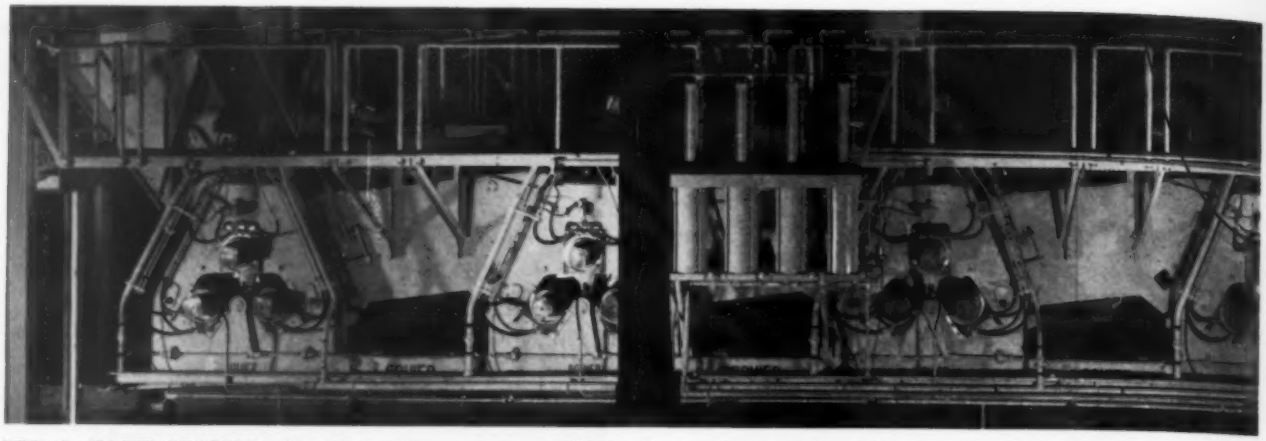


FIG. 1. FOUR STANDS of a 15 stand sugar cane mill are shown here. Each of the upper main rolls is pressure loaded by one of the air-oil boosters seen mounted in the center.

AIR-HYDRAULIC BOOSTERS Put the Squeeze on Sugar Cane

By Earl A. Drollinger

A completely integrated power unit with its own air compressor develops a regulated hydraulic pressure on the mill rolls

BECAUSE machinery used in the processing of sugar cane must operate continuously under severe conditions, design and construction must be simple and trouble-free with a minimum of allowable maintenance. These boosters meet the problem.

The grinding of sugar cane is a continuous pressure operation which has been accomplished with some type of fluid power source for more than twenty years. Prior to that time, counter-balance weights, springs, or some type of mechanical linkage were used to exert the required squeezing pressure.

As new compact fluid power components have been developed, they have been incorporated into the design of sugar cane mills. With several methods available for pressure loading rolls, The Squier Corporation has selected the air-hydraulic booster because of its simplicity and compactness, the ease of its regulation, the non-shock cushion effect of pressure application, the low initial and operating costs as well as its foolproof operation.

EARL A. DROLLINGER, The Squier Corp., Buffalo, New York

Booster Develops 190 Ton Force

Four stands of a 15 roll cane mill, built by The Squier Corporation, Buffalo, New York, are shown in Figure 1. The schematic in Figure 5 shows the application of air-hydraulic boosters for loading each 3 roll stand. The booster unit has a 2½ inch diameter oil cylinder, a 10 inch air cylinder, and a stroke of 25¼ inches. Each booster steps up 186.7 psi air pressure to 2987 psi oil pressure, which acts on two 9

. . . low maintenance is the first consideration in selecting a pressure loading system for sugar cane mills

inch diameter rams in the mill housings to place 190 tons across the width of the 36 inch top roll in the mill.

In operation, the main roll of each 3 roll mill floats approximately ¾ inch above its normal setting due to the cane that passes through the mill, so that there is continuous hydraulic presure to express the juice in the sugar cane.

In case of emergency when a choke in the mill develops or tramp iron is seen approaching the rolls, a separate hydraulic system is used to prevent damage. In addition, this system will also raise the roll to sufficient height so that the turnplate or doctor which turns the cane from the main and minor feed roll to main and minor discharge rolls can be serviced and removed without tearing down of the machine.

5,000 PSI Lift System

This hydraulic system includes a power package unit having an 11 gpm axial piston pump driven by a 15 HP motor. Incorporated in this package is a hydraulic pressure regulating valve which by-passes the excess oil through a cooler and back to the 55 gallon tank. The maximum pressure of the unit is 5,000 psi. A 3-way solenoid operated normally closed valve is actuated to raise the single acting roll rise

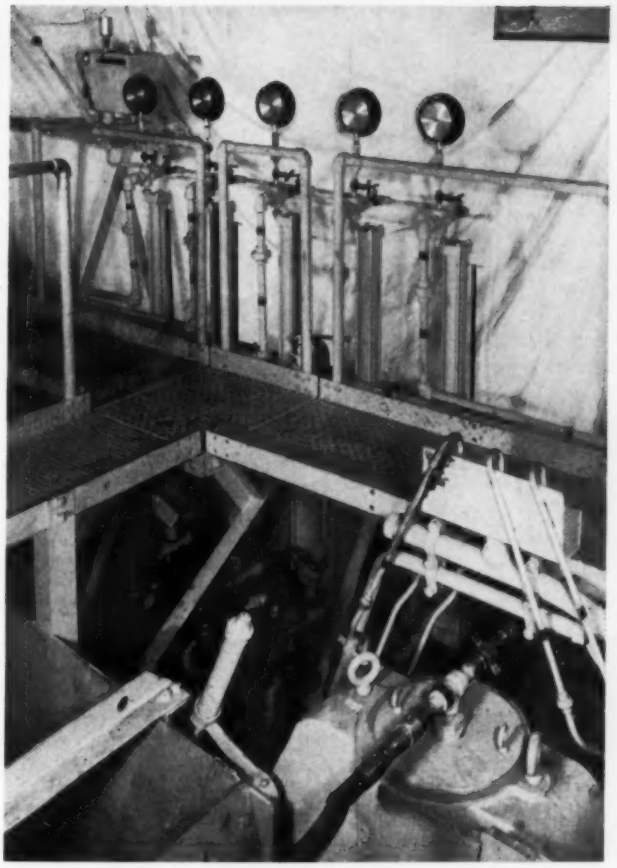


FIG. 2. CLOSE UP of the operating side of the boosters showing the oil surge tank, hydraulic priming hand pump, boosters, pressure regulating valves, and 3-way solenoid operating air valves. The upper part of the cane mill housing which houses the ram mechanism can be seen.

FIG. 3. SHOWS THE FAR side of the boosters and a close up of the cane mill. Note the quick disconnecting hydraulic and water cooling hoses.

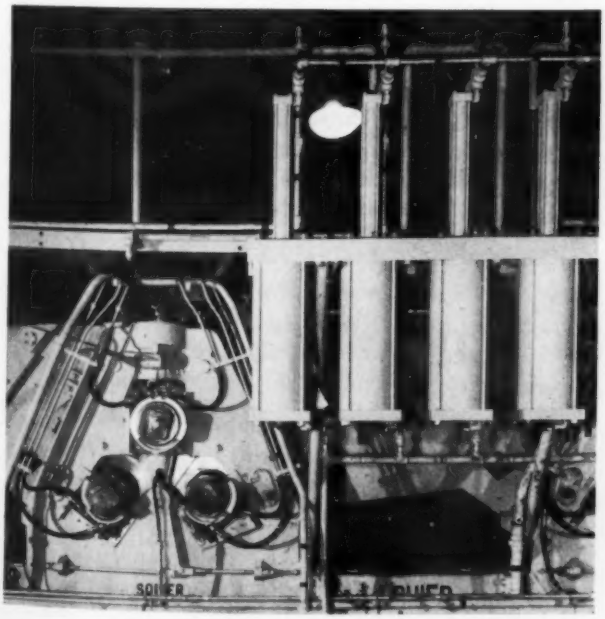
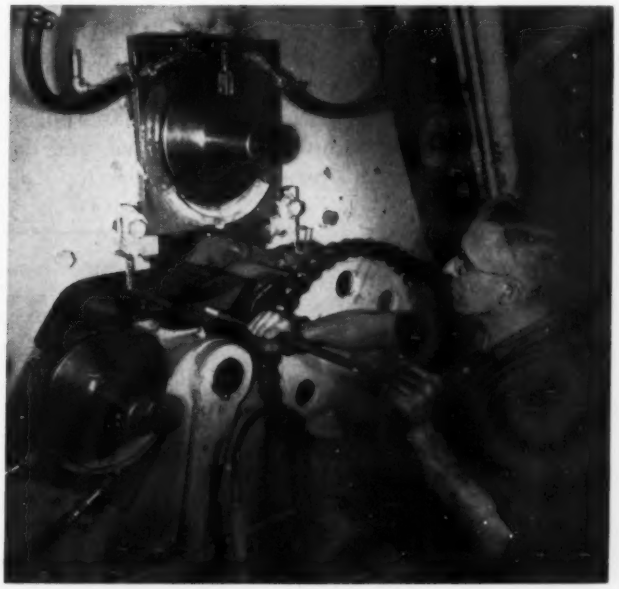


FIG. 4. A WORKMAN is removing the turnplate after the roll has been raised and locked at its maximum height. The lower jack is removed.



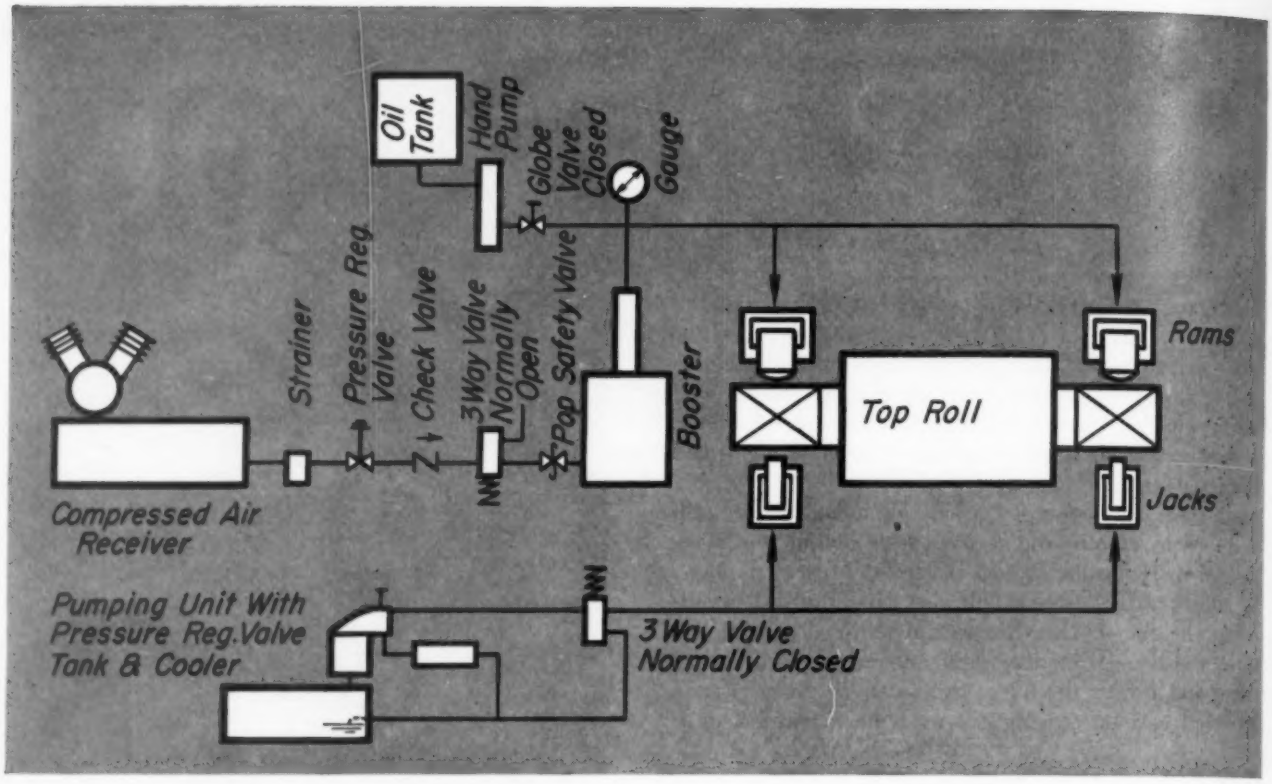


FIG. 5. ON THIS particular sugar cane mill, a 2 stage 250 psi, 68 cfm air compressor mounted on a 120 gallon receiver is used to serve five boosters. With the air compressor supplying driving pressure to the accumulators, the main roll is loaded with a 190 ton force. Pressure may be released by push button operation to actuate the 3-way air valve and exhaust the booster. An air safety valve is set at 195 psi to protect the system. Hydraulic pressure on the two 9 inch diameter rams in the mill housings is read directly on the pressure gauge. A portable hand pump is used to prime the system with oil from the small 700 cu in tank.

To raise the rolls for repair or to permit passage of tramp iron, a separate 5,000 psi hydraulic power package supplies oil to the two jack cylinders.

jacks which have a 1⅜ inch diameter ram by 4½ inch stroke.

Other models of this mill are built incorporating the rise ram into the mill ram making this a double acting unit.

These mills are arranged to be controlled from a single 3 button control. Pressing the down button admits air to the boosters and places hydraulic pressure on the mill rams.

Should a piece of tramp iron be seen, then the operator presses a button which opens the 3-way air valve to pass the air in the booster to the atmosphere, at the same time the pumping unit is started, and the 3-way hydraulic valve opened to raise the top roll permitting the passage of tramp iron.

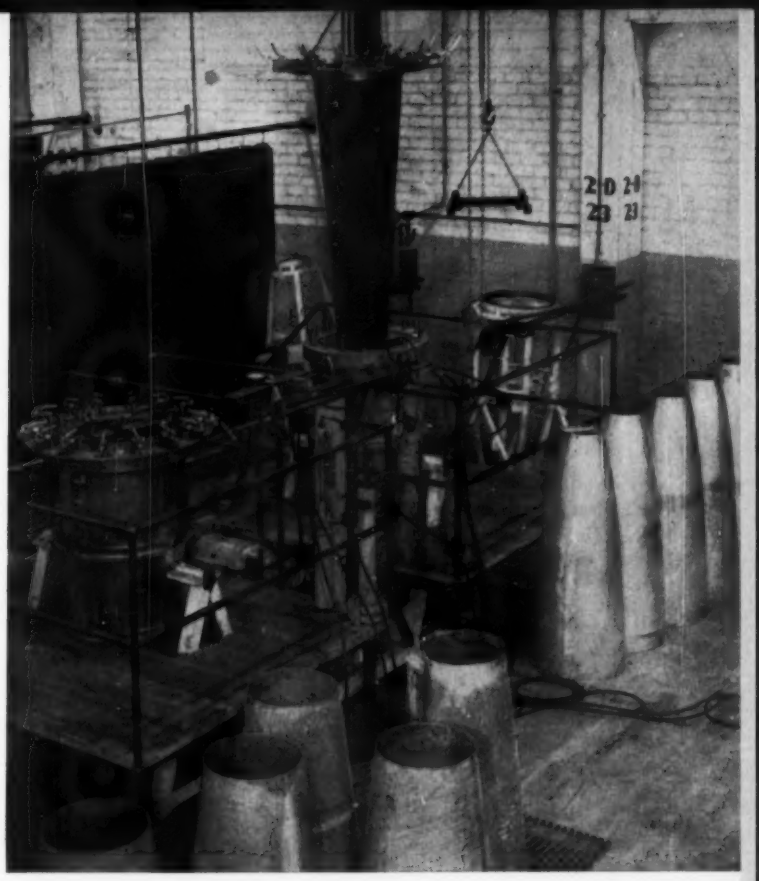
This operation is accomplished in less than one second. Should the operator wish to raise the roll still higher to permit removal of the turnplate, he must first remove a pressure plate limiting the travel of the ram by hand, next open the globe valve, which will then allow the jacks to travel to their full height by passing the oil in the line from the rams through the hand pump into the oil receiving tank. While these repairs are being made, the control mechanism is switched to "off." The pump unit stops to prevent the pumping unit from overworking and the oil oxidizing. A safety lock in the housing is engaged, and the lower jack is shifted sideways.

Ninth Annual NCIH

Plan to attend the two day meetings of the ninth annual National Conference on Industrial Hydraulics. This year, meetings will be held at the Sheraton hotel in Chicago on Thursday and Friday, October 8 and 9.

Papers are being prepared on applications and recent developments of oil powered equipment in aircraft, automotive, instrumentation, machine tools, presses, mobile equipment and industrial nonflammable fluids. Several papers will be devoted to design aspects of hydraulic components.

Registration blanks may be requested by writing John G. Duba, Conference Secretary, National Conference on Industrial Hydraulics, Illinois Institute of Technology, Technology Center, Chicago 18 Illinois.



VIEW OF THE specialized "hydro-sizing" set-up. Two molds are used to speed the work. One can be unloaded and re-loaded while the bag in the other is accumulating forming pressure. Hydraulic forming bag and cover are seen suspended over one mold. An internal mandrel in the bag reduces hydraulic oil requirements to approximately 25 gallons. About three minutes are needed to reach the necessary 350-450 psi forming pressure. Tank sizing time is about 5 minutes floor-to-floor.

Oil Expanded Bag Lowers Metal Forming Tool Costs

By Gilbert C. Close

"HYDRO-FORMING" and "hydro-sizing", two similar processes in which metal is formed by using a hydraulically expandable bag to force the metal sheet into or against the proper mold or die, is gaining rapid prominence in the aircraft industry. This is largely due to the simplicity of the process and the relatively low cost of the tooling involved. While the aircraft industry is faced with producing thousands of formed sheet metal parts for each airplane, the production run on each type of part is low and tool cost amortization becomes a large factor in the final cost of the airplane. By using the rubber bag method of metal forming, many specialized low-cost tools have been developed for specific jobs.

A typical example of such a tool is the "hydro-sizing" machine developed recently at the El Segundo Division of Douglas Aircraft Company for the final sizing operation on externally carried expendable airplane fuel tanks. These tanks are fabricated from 61 S aluminum alloy, and require accurate external contours to maintain the pre-calculated aero-dynamical efficiency. In the start, a few of these tanks were produced by metal spinning, but this process proved both costly and slow. It was then decided to design and

. . . air operated piston ejects finished tank from pressure forming fixture

build a hydro-sizing machine which could produce the required contour tolerances both economically and with utmost speed.

In planning this project, the Douglas tooling engineers took into consideration that some warpage would occur during heat treatment of the pre-formed tank halves, and more warpage would occur when the two halves were welded together. These dimensional errors, plus errors originating during initial drop hammer forming of the halves would have to be removed in a final operation. It was thus evident that hydro-sizing would have to come last and produce tank contours meeting the stringent design tolerance demands.

Hammer, Trim and Weld Operations

In fuel tank production, the 61 SO material is first drop hammer formed into half-shell sections. These sections are then rough-trimmed so that they will fit into a precision trimming fixture. The trim saw fixture produces a true and straight edge on both half-shells to facilitate the subsequent automatic Heliarc butt-welding operation.

The automatic welding fixture is similar to the trim saw fixture. Pneumatically operated lever clamps hold the two halves in correct position against a contoured support block. A solid copper contoured bar is embedded in the support block just behind the weld area to aid in heat dissipation and minimize warpage insofar as possible.

When mounted in the welding fixture, the tank skins are automatically indexed with a constant clearance of 1/32-inch along the butt weld joint area. The automatic Heliarc welding torch is kept at a constant angle to the work surface by a follower arm on which it is mounted, and which in turn operates against a guide template that conforms to the shape of the tank.

After welding, the tanks are heat treated to the "W" condition, then placed in sub-zero storage to prevent aging and keep the metal soft until final hydro-sizing. This must be accomplished within 24 hours as the elasticity of the metal in the welded area grows progressively less with age.

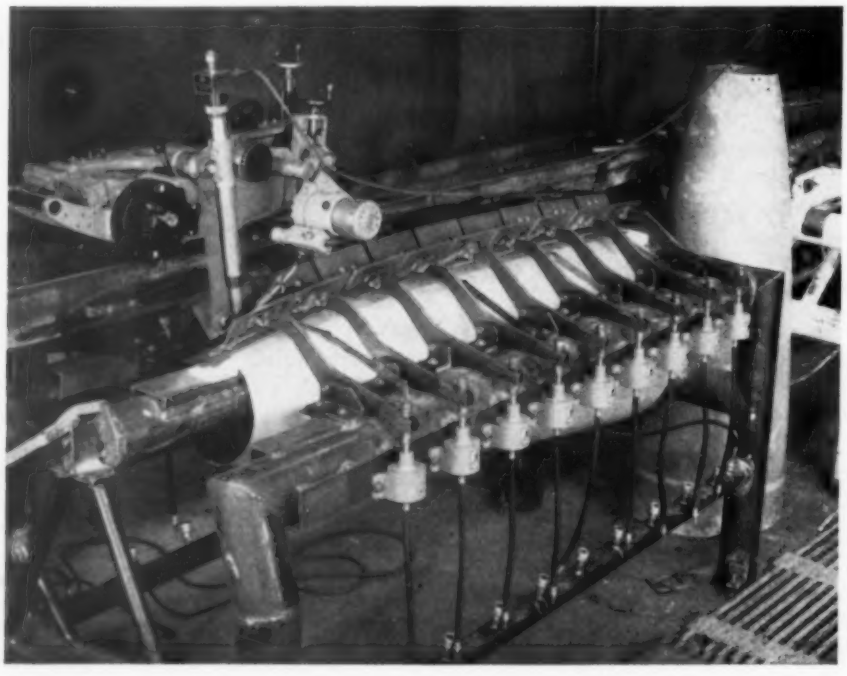
The mold on the hydro-sizing machine is constructed in two sections, each cast from high-grade aluminum casting alloy. Aluminum was used for the mold mainly because of reduced time and cost of the machine operations required to complete it. These mold halves are bolted together, and have been hydraulically stress tested at 500 psi, a figure substantially above the pressures used in production work.

It was noted, however, that at the 500 psi stress test pressure, the mold "stretched" or enlarged slightly. This enlargement was not sufficient to extend the metal beyond its yield point, and the mold would return to normal size when the pressure was removed.

"While seemingly unimportant, this pointed up an extremely important factor in the design of hydro-sizing molds," a Douglas tooling engineer explained. "Such molds, and especially a mold in which the part is nested, must never enlarge or stretch when used at normal production pressures. This stretching not only affects final tolerances, but when the mold returns to normal size after the pressure is removed, it is almost impossible to eject the nested part."

The Douglas hydro-sizing mold is equipped with a pneumatically-operated piston at the bottom, used to eject the finished tank. Under normal conditions, this piston operates at from 100-200 psi. The booster pump

Concluded on page 127



HERE AN AUTOMATIC Heliarc welder welds the two jigged tank halves together. Note follower arm acting against the contoured template which maintains a constant angle between the torch and work surface, thus assuring consistent maximum results. Air cylinders actuate the clamps.

Photos from El Segundo Division of Douglas Aircraft Company.

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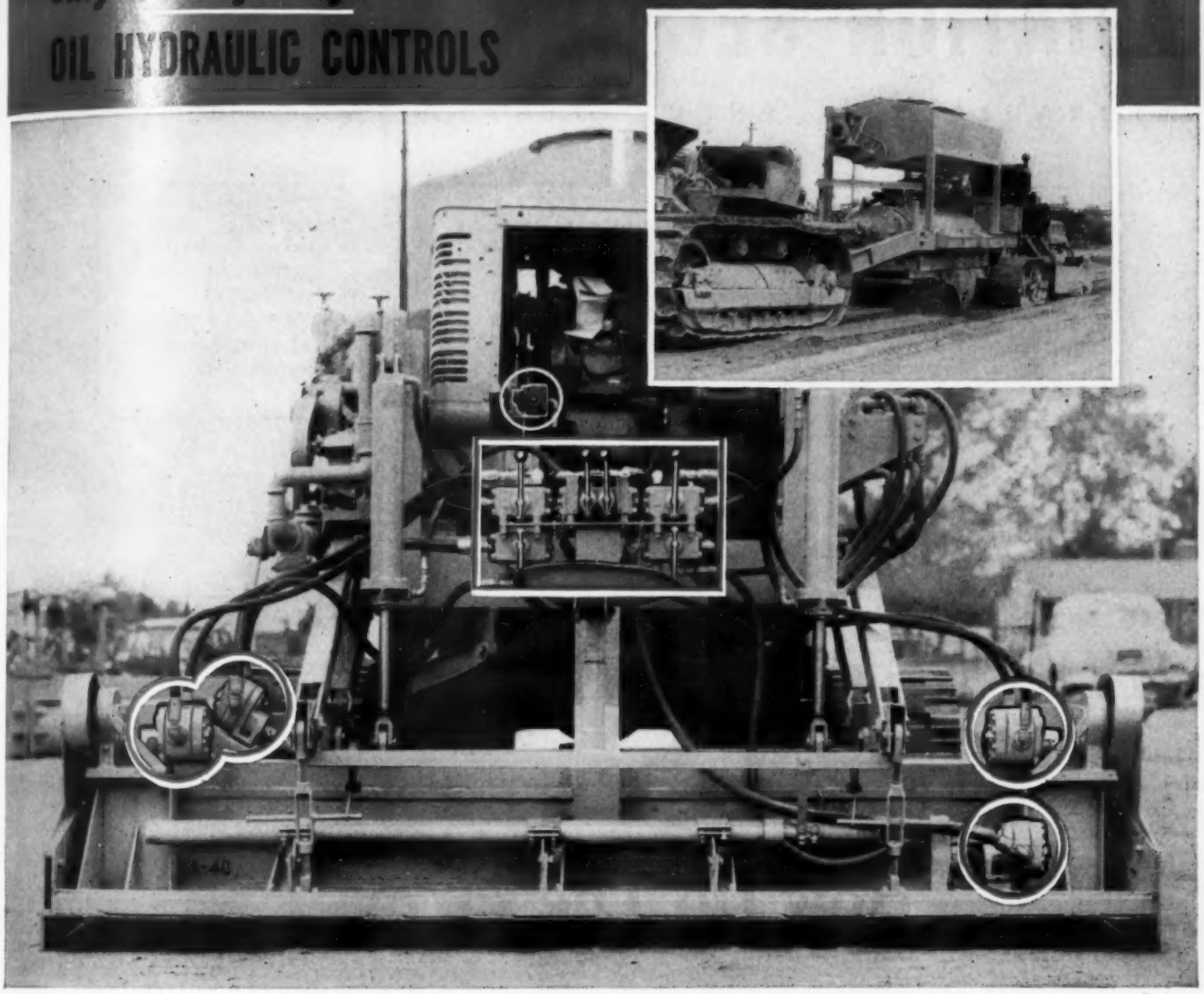

could so simplify such a complex power transmission

Miles and miles of old or worn out roads or highways are being reclaimed by scarifying, pulverizing and preparing the old hard surface for re-use. The aggregate is then ready for re-mixing with new bond and laid down, spread and graded ready for rolling.

The transmission of power to operate the many mechanical devices which perform such a complexity of operations has been so simplified by the use of oil hydraulic fluid power. Motors drive rotating mechanisms, cylinders actuate push-pull movements, pumps generate the fluid power and valves direct it—all work together in a series of circuits. All motions are positive and subject to complete control. All of the fluid powered operating devices occupy less space and the complete installation is engineered at substantial savings when compared to other types of power transmission.

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HYDRAULIC FUSES...

What Are They?
How Do They Work?

By Harry Hedland

HYDRAULIC fuses are devices that act automatically to protect main power supply lines or subsystems in hydraulic circuits against leaks or failures. Fuses may be used to isolate ruptured circuits; they offer the maximum protection against fire hazards and complete loss of fluids in hydraulic systems.

Modern aircraft hydraulic systems are complex, with an apparently cumbersome array of cylinders, valves and gadgets all tied together by means of rigid and flexible tubing. Aircraft hydraulic systems extend from aileron to aileron, from nose wheel to rudder, into the engine nacelles and the cockpit. Efficiency requirements and weight considerations dictate the use of as few pumps as necessary and that reservoirs be as small and few as possible.

HARRY HEDLAND, Director of Engineering, Waterman Engineering Co., Evanston, Ill.

It is not the writer's intention to portray hydraulic fuses as the only possible safeguard against the failures that inevitably occur in aircraft hydraulic systems. There are many means of guarding against hydraulic failures. An exhaustive study of these means has been made by Ed Meripol of the Hughes Aircraft Company; the report of this study has been published by the United States Air Force as "AF Technical Report No. 6348, in December, 1950.

Aircraft System Conditions

Hydraulic fuses owe their very existance to the many hazards of such complexity. An airplane in operation, particularly a military airplane, will impose every conceivable type of torturous treatment upon the various components. Components will be required to resist high and low frequency vibrations of any conceivable amplitude, the effect of temperature variations of several hundred degrees F, accelerations up to 10, 12 or more g's, poor or sketchy maintenance

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Hydraulic Fuses

and, in the case of military planes, enemy gunfire. The safety factor of an aircraft hydraulic system is, to a great extent, limited by the weight which the hydraulics group is allowed; the system is then attached to a semi-rigid frame and from that day on, the hydraulic system is responsible for performing the many functions that are required for maintaining an airplane in flight.

There are many types of hydraulic fuses, operating on as many principles. There are two types which have been accepted to the extent that the Services have issued standard drawings to cover them. These are AN 6281 and AN 6282, both of which are required to conform, performance wise, to specification MIL-F-5508.

Both of these units are of the "Quantity Measuring" type i.e., they will close after passing a predetermined (and fixed) quantity of fluid. The difference in the two units is in the means of resetting.

Parallel Flow Type 1

The type 1 or AN 6281, shown in Figures 1 and 2, is designed to reset itself by an internal spring mechanism, provided the capacity of the fuse has not been passed or whenever the pressure on the two ports is equal. Figure 1 shows the fuse in a partially fused position, with the flow in the direction for closing. Figure 2 shows the fuse in a static or normal flow position.

Parallel Flow Type 2

The type 2 or AN 6282, shown in Figure 3, is designed to lock itself in a partially fused position when flow ceases and to remain locked in that position until flow is resumed. The advent of reverse flow will reset the fuse.

The type 2 design has the advantage that when used in a circuit where a partial cycle is made, the volumetric capacity of the fuse is reduced by making such a partial cycle. Such action is of particular value when the fuse is used in conjunction with a large volume cylinder that might be extended over long periods of time with pressure maintained. Because the cylinder is extended, the fuse capacity has been nearly passed and the line is vulnerable because it contains fluid under pressure. However, if such a line is ruptured, only a few cubic inches of fluid will be lost before the line is isolated by the fuse.

The quantity measuring fuse is, as the name implies, a device to measure the volume of a fluid. It might more properly be described as a delayed action check

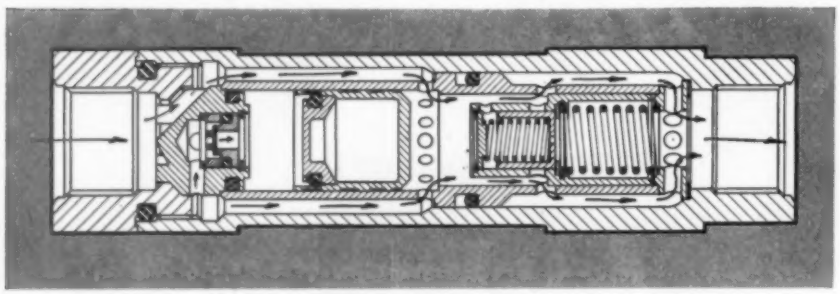

Fig. 1. THE TYPE 1 (AN 6281) hydraulic fuse is a quantity measuring parallel flow type that resets itself by an internal spring. It is used for circuits of limited volumetric capacity. The fuse is shown in a partially fused position, with flow in direction for closing.

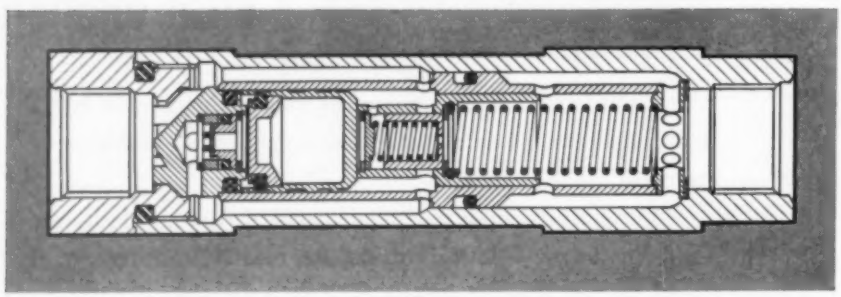

Fig. 2. THE TYPE 1 FUSE is shown in static position (no flow). This type will remain open unless an above normal volume of flow passes through it.

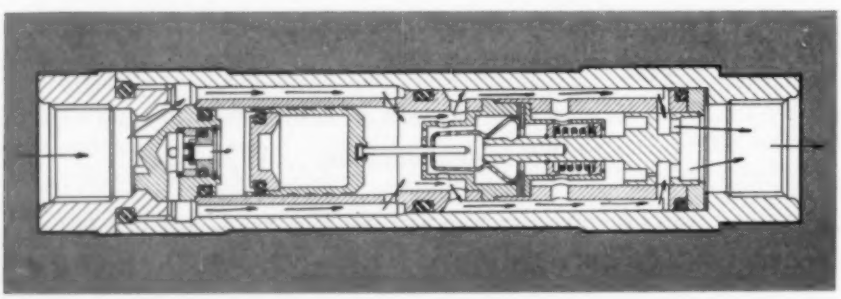

Fig. 3. THE TYPE 2 (AN 6282), a quantity measuring, parallel flow type hydraulic fuse is shown partially fused and in the position assumed during flow in closing direction. This type can be advantageously used for larger volumetric capacities than type 1.

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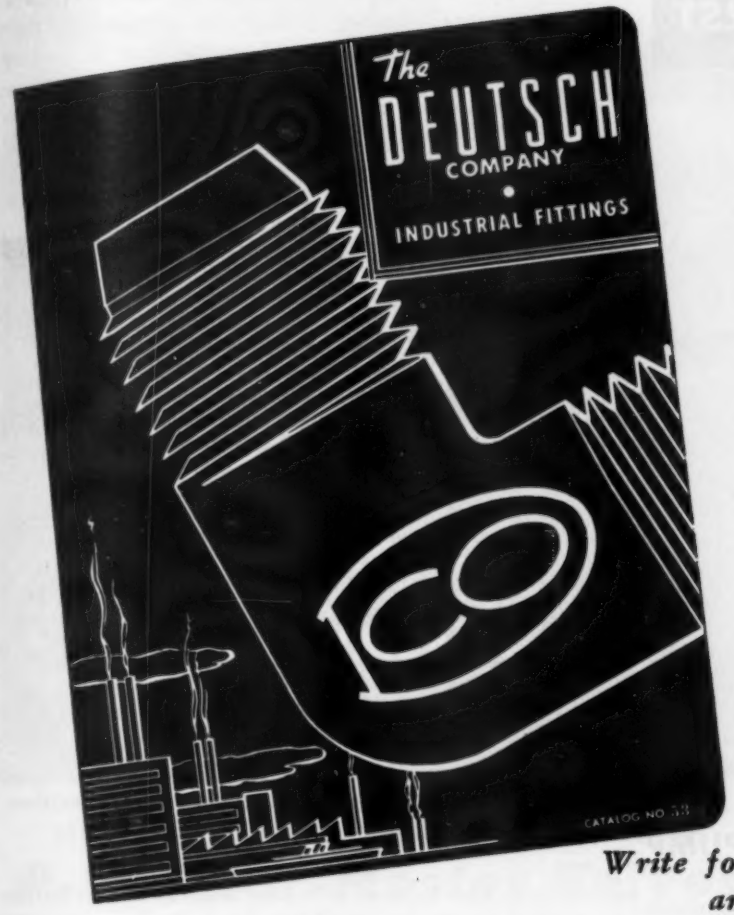

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valve, since its function is just that—to pass the amount or volume of fluid required to perform a given operation, but to close if the subsystem demands more than a normal quantity of fluid due to leaks or a ruptured tube. It is obvious, of course, that in normal operation, with the fuse calibrated for slightly more volume than the working capacity of the subsystem which it serves, the fuse will never close. The signal for this type of fuse to close is an above normal volume

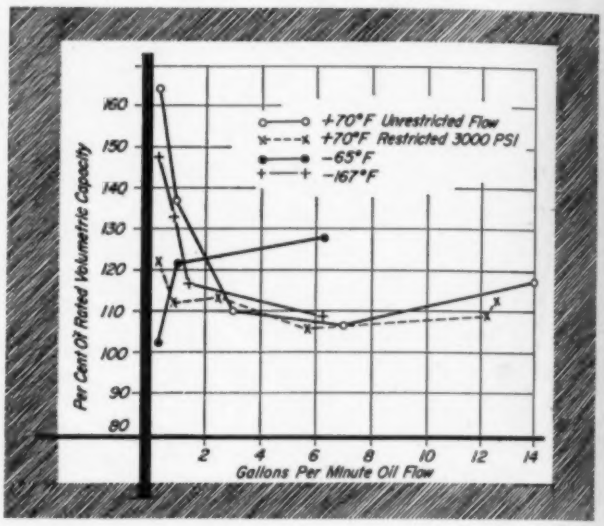
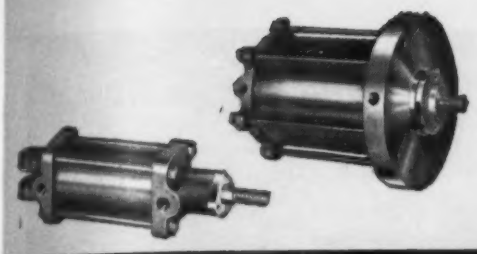


Fig. 4. TYPICAL volumetric capacity vs flow rate curves for various standard capacities under various conditions. Drawings and chart by the author

of flow. This type of fuse can be, and is, successfully applied to circuits involving fixed displacement actuating cylinders or fluid motors of limited motion. These fuses operate at flow rates of from one tenth gpm up to, and in some cases, exceeding 12 gpm. Figure 4 shows typical volumetric capacity vs flow rate curves for various standard capacities under various conditions.

Either type 1 or type 2 quantity measuring fuse can be effectively utilized as a fire prevention device. A typical example would be on the cowl flap cylinder where flexible hose is used. Should the hose fail, as it often does, the fuse would limit to a minimum the amount of fluid that is sprayed into the engine compartment. A few cubic inches of fluid will not create such a conflagration as will several gallons. Without adding to the never ending controversy over the relative merits of flammable versus nonflammable fluids, it might be stated that those who have the least experience with hydraulic fuses have the majority of the troubles with the flammable fluids.

"Survey of Research Projects in the Field of Aviation Safety," just released by the Cornell-Guggenheim Aviation Safety Center, 2 East 64th St., New York 21, N. Y. gives brief descriptions of projects being carried on in research centers throughout the country.



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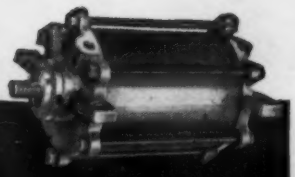

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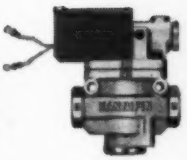
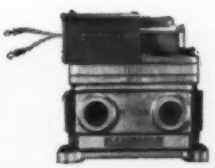
Write for Bulletin 231.

2 and 3-Way Valves.

Same valve operates 2-way or 3-way, normally open or normally closed. ⅜″ to 1¼″ I.P.S.





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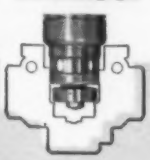
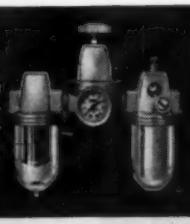
Two 3-way valves mounted in compact, common body. Two piston poppets. Two cartridges. ⅜″, ½″, ¾″ I.P.S.

EXCLUSIVE REPLACEABLE CARTRIDGE



AIR WARDEN

Air filters, pressure regulators and lubricators to protect air operated equipment. Bulletin 10108.



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Write for Bulletin 57-W

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THUNDERJET F-84 has a speed of more than 600 mph; a combat radius greater than 850 miles and a service ceiling beyond 45000 feet. Powered by a 5600 pound thrust turbo-jet engine, this plane is equipped for mid-air refueling.

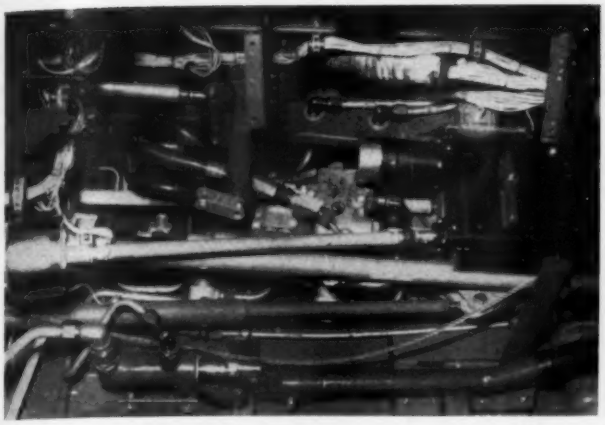
HYDRAULICS on the F-84

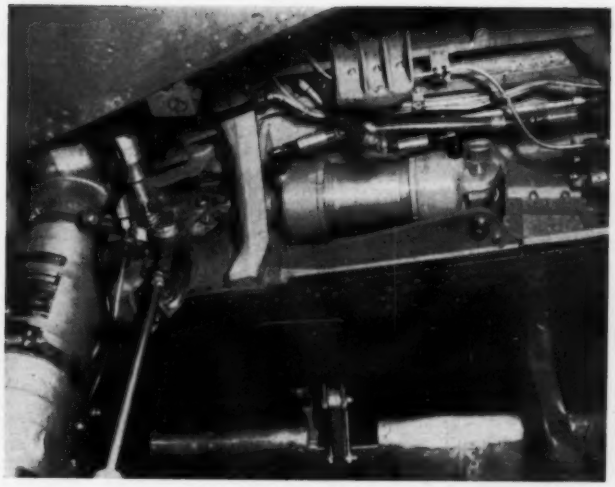
THROUGHOUT the assembly area at Republic Aviation Corporation in Farmingdale, N. Y., hydraulic test rigs have been placed to check components before and after installation in the F-84's.

The problem of accessibility of components is extremely severe on aircraft where both space and weight are at a premium. Use of manifolds and access panels has greatly simplified assembly as well as permitting ready servicing and speedy replacement of parts.

Shown here are several photographs taken at the Republic plant to indicate a few of the assembly and testing techniques that are being applied to the F-84's.

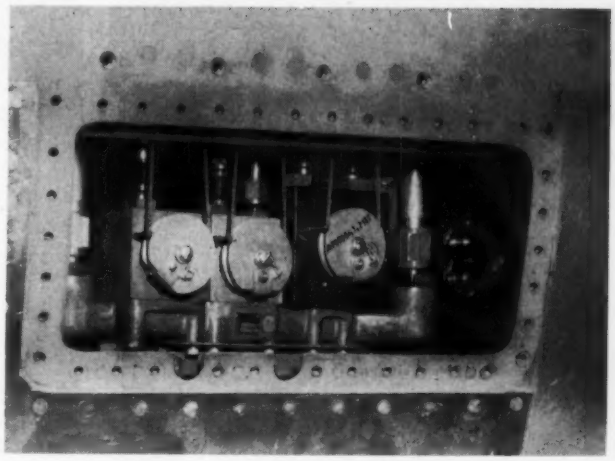
REGULAR LABORATORY facilities have been set up to check performance of hydraulic and pneumatic components. Flow and pressure tests on an engine mounted pump are being made on this test stand.





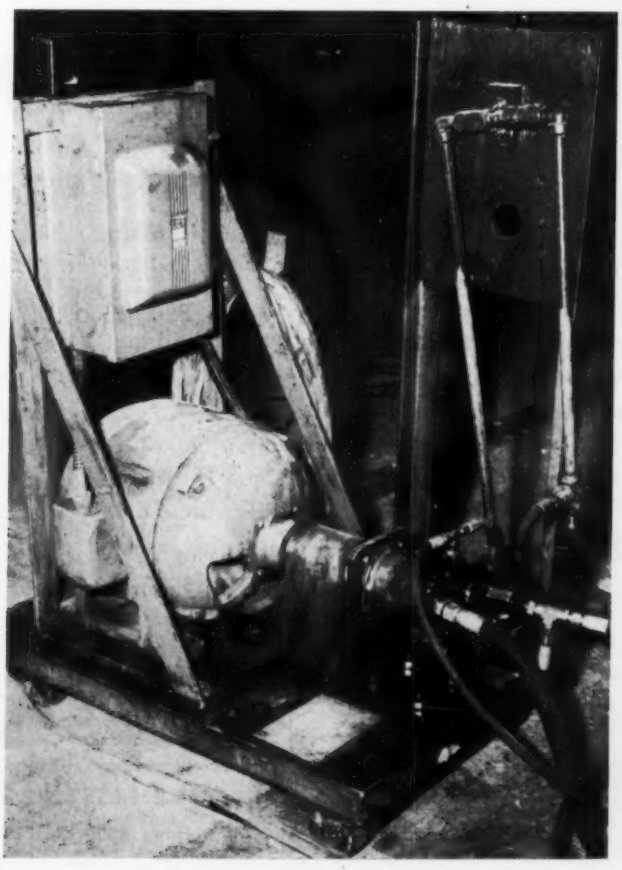
AILERON BOOST installation on this fighter plane and the landing gear installation show the close working quarters for installing the hydraulic cylinders and actuating linkages. On the aileron boost circuit, the hand pump is seen in the foreground, means are provided for variation of boost ratio to suit the pilot. Means are also provided for mechanical disconnect and reconnect in flight.

On the landing gear installation, vinyl covering on the hose lines to the cylinder is used to prevent abrasion.



VALVES on the F-84 are grouped as a manifold. An access door in the plane's fuselage permits ready inspection of valves and makes possible their removal from the airplane without disturbing ducts which are immediately behind the unit.

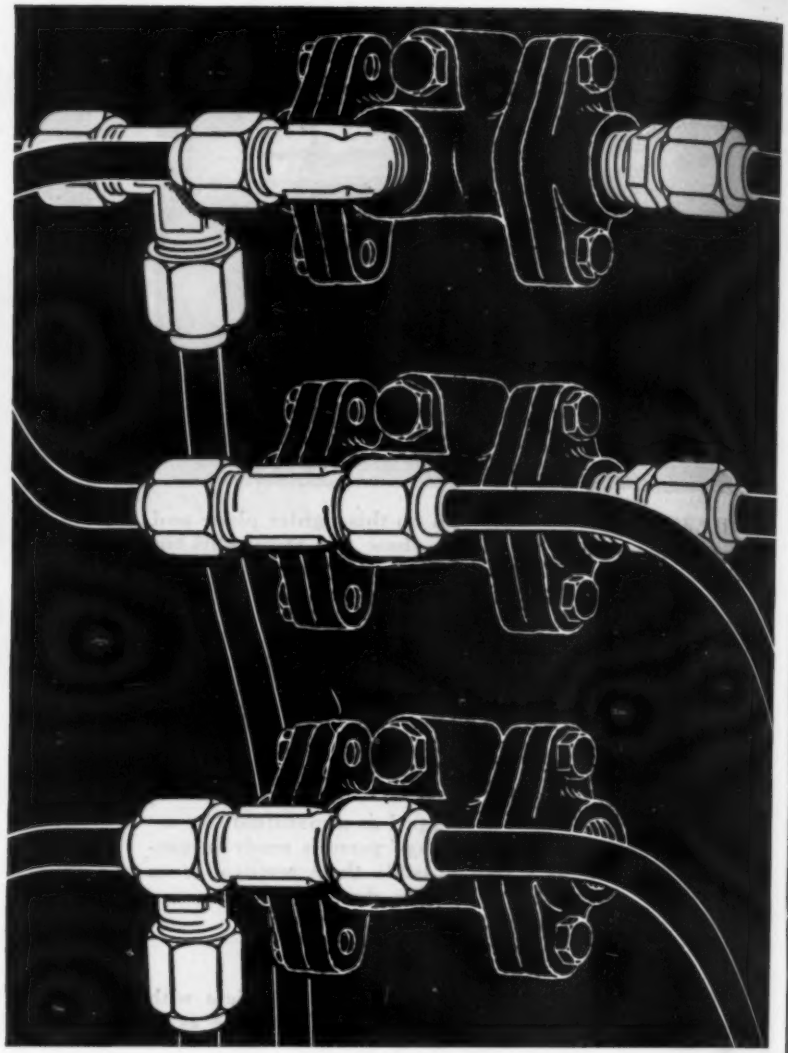
THE CASTER mounted pumping unit, complete with electrical drive has the same pump and flow rate as in the airplane. Ground tests which produce results comparable with those in flight are made.



LOCATED out on the assembly line, hand pump test stands do preliminary functional testing. The unit permits positioning of operating cylinders on the plane to check for clearances before the plane's hydraulic power pump is put into operation. The unit assists in making adjustments during the original assembly before the plane reaches final check out.

ON DIESEL ENGINES

This typical Diesel engine manufactured by The National Supply Company, Engine Division, Springfield, Ohio, is equipped with Parker Triple-lok Fittings.



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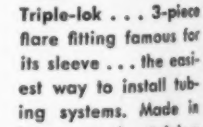

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Here's a report of aircraft hydraulic and pneumatic papers presented at the . . .

SAE National Aeronautic Meeting

ONE full day, Wednesday, April 22, at the SAE national aeronautic meeting was given over to fluid power problems. Three meetings, sponsored by the Aircraft and Air Transport Activities with the cooperation of SAE Committee A-6, were held. The morning meeting was a symposium on high temperature hydraulic systems; the afternoon session was on the theme of increased reliability of aircraft hydraulic systems; the evening session was given over to two papers on pneumatic systems and their components. This was the first time that Committee A-6 took responsibility for a major part of the national aeronautic meeting.

In the high temperature symposium Frank C. Mittell, Hydraulic Group Engineer, North American Aviation, Inc., read a paper on "High Temperature Problems Associated with Aircraft Hydraulic Systems." He pointed out that the hydraulic designer must design units that are heat generators, e.g., pumps and continuous operating hydraulic circuits to meet higher operating temperatures efficiently, components for increased allowable operating temperatures and that system installations to reduce the absorption of heat from high ambient conditions.

George R. Keller, Supervisor, Power Elements Division, North American Aviation, Inc., Downey, Calif., in his paper, "Adventures in Extreme Temperature Hydraulics" reviewed the specific problems faced with the new "thermal" barrier. He reviewed test experience with new types of hydraulic fluids at elevated temperatures in use on a simple proportional servo system, gave results of pump accelerated wear tests at high temperatures and the effects on standard packings under operation at elevated temperatures. He also gave test results for accumulators, filters and relief valves under the same extreme conditions. He concluded that much more test and design work must still be done to arrive at satisfactory components for operating temperatures in the range of 350 or 400 F, that possibly a new approach to sealing is indicated (reed and chevron seals) and that the limited lubricity of available fluids at high temperatures will make it very difficult to develop a pump or pumps which are efficient at high temperatures.

High Temperature Packings

E. L. Carlotta read a paper which he and E. M. Hobein had prepared. Mr. Carlotta is Manager of Rubber Research and Development, Mr. Hobein, Supervisor, Rubber Laboratory, both of The Parker Appliance Co. The paper, "Limitations of Synthetic Rubber Packings for High Temperature Application" reviewed the effects of high temperature on the rubbers now in use and summarized the chemistry necessary to produce a material which would fulfill the characteristics that would be required. He reviewed the individual advantages and limitations of four of the leading elastomers and pointed out that more basic research must still be done before the rubber fabricator can develop specific materials for the high temperature applications faced in the aircraft industry.

J. C. Mosteller and Lt. John A. King, USAF, both of Wright Air Development Center, prepared a paper on "The Development of High Temperature Hydraulic Fluids" which was given by Lt. King. The paper briefly reviewed the work done at ADC Materials Laboratory on a considerable number of syn-

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thetic hydraulic fluids. No clear picture of any one fluid development that promises to be a successful answer to the high temperature problem emerged. The goal being sought is to provide a fluid for high temperature hydraulic systems that will be a satisfactory lubricant, be thermally stable from 400 to 600 F and be produced from readily available materials.

System Reliability

At the afternoon session three papers were heard on the general theme of design for increased reliability of hydraulic systems in aircraft. Leo M. Chattler, Head, Actuating and Flight Control Systems Section, BuAer, read his paper on "Design for Increased Reliability of Aircraft Hydraulic Systems." He laid down factors which affect reliability as complexity, interconnected systems, peak pressures, back pressure effects, flow effects both reduced and increased, acceleration, depressurization, proper air bleeding and high temperature. He illustrated each with examples on actual aircraft. He summarized by showing a table which included each of these reliability factors and a system analysis in each case as a check or correction.

Howard Field, Jr. Hydraulic Design Specialist, Consolidated Vultee Aircraft Corporation, spoke on "Designing Hydraulic Systems to Increase Dependability of Tomorrow's Airplanes." He defined dependability as the probability that there will be no failure from any cause; that this property must be improved. He pointed out that hydraulics will continue to become more and more important to aircraft. He predicted closer tolerances and fits in manufacture of hydraulic components, the application of higher unit pressures and smaller, heavier tubing and lines. He gave as the five most important properties of a fluid that will be necessary at the increased temperatures that will be encountered as: long wearing properties; corrosion protection; temperature suitability for a given range of operating temperatures; high viscosity index and compatibility with finishing and insulating compounds. He pointed out that the critical factor remains the limited amount of time and money available for the design of any airplane. He gave three suggestions for improving dependability: (1) increase in automatic operation to decrease human error; (2) avoid piling emergency systems in superimposed layers, pointing out that one good original system plus one good emergency device was mathematically more reliable than the addition of another device, less perfect, to "ride herd" on the first two; (3) avoid closely related adjustments, particularly those which are only marginally possible, e.g., a pressure switch might have to operate at a pressure between 2800 and 2925 psi in order to operate after a valve which might be as high as 2800 and before another device which might be as low as 2850 psi.

The third paper in the reliability session was given by J. W. Kelly, Adel Division, General Metals Corporation. His subject was "Design and Development of Aircraft hydraulic Components for Increased Reliability." He pointed out that the design phase of a hydraulic component was perhaps the most important as the time and place to eliminate bad features. He defended combination units where they were well designed and reliable. He listed several "Hidden factors" as influencing reliability: leakage; flow capacity, pressure range, back pressure and co-functioning conditions. The latter is often difficult to assess because the designer often does not know where his component fits in a system. He pointed out that laboratory and qualification testing were sometimes not realistic and advocated a closer review of actual operating conditions. Examples of manufacturing control were cited to illustrate effect of non-availability of critical materials, close tolerances and very small manufacturing lots.

Pneumatics Session

The first paper, "Method for Predicting Pressure Drop in Pneumatic Components and Systems" was the

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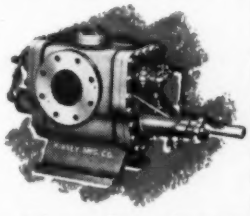

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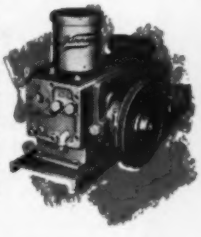

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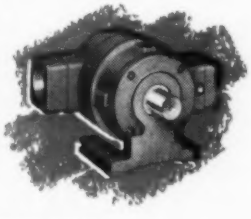

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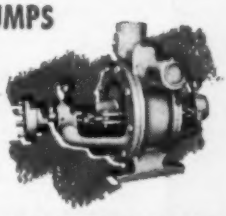

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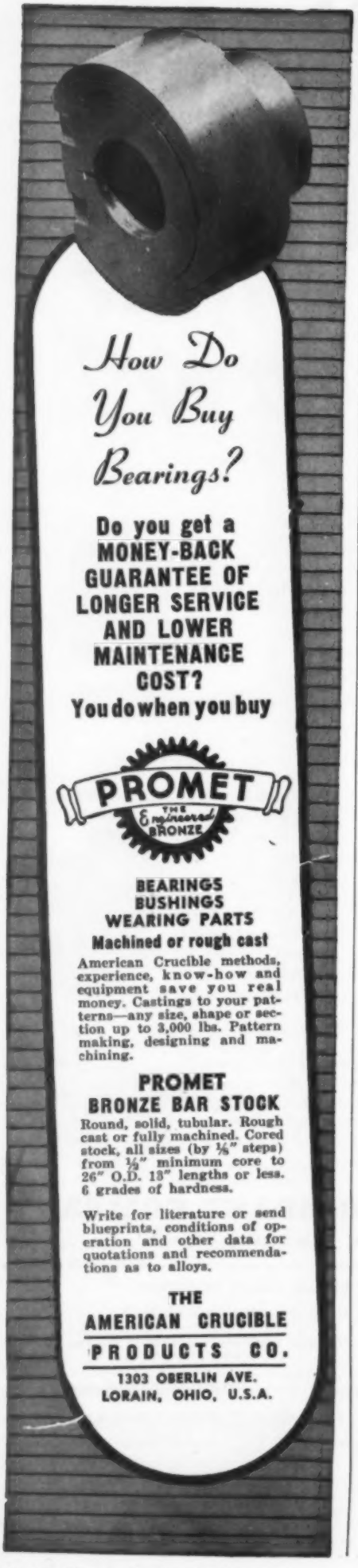
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joint work of M. M. Slawsky and Morton Lutzky of the National Bureau of Standards and A. E. Schmidlin of Walter Kidde and Co., Inc. The paper was read by Dr. Slawsky, who is in charge of the BuAer fundamental research and development program. The paper outlined the performance of fixed-orifice pneumatic components by an analysis of the upstream conditions and the flow factor. The latter is constant and, when determined either by experiment or by theory, can be used to predict valve performance for a wide range of upstream conditions. The flow factor for long lengths of tubing in a pneumatic system was determined theoretically and checked experimentally. The importance of this investigation indicates that one characteristic curve for a valve can serve for a wide range of upstream pressures and that a pneumatic system may often be described by a single flow factor, if tubing is neglected. Dr. Slawsky is continuing this work and promised to report later on further progress.

Robert R. Bayuk, Wright Aeronautical Center, read his paper on "Pneumatic Actuating Systems in the U. S. Air Force." The paper reviewed the advantages of pneumatic systems for air craft and gave examples of early uses of pneumatic systems to Air Force planes. He described the pneumatic system proposed for the T-29E or Convair 340 airplane in some detail as representative of pneumatic actuating systems. The advantages of pneumatic systems in high ambient temperatures were stressed, pointing out that only the compressor requires cooling. He predicted that power for operating the control services of high speed aircraft would be by either separate hydraulic systems or a low pressure pneumatic system.

Report of SAE Aircraft Committees

THE SAE A-6 Committee on Aircraft Hydraulic and Pneumatic Equipment held their semi-annual meeting at the Governor Clinton Hotel, New York, on Tuesday, April 21, Thursday and Friday, April 23 and 24.

When chairman B. R. Teree called the Tuesday meeting to order over 200 persons representing manufacturers, suppliers, airframe companies and the services were in attendance. At one point nearly 250 persons were in attendance. Although not announced as the theme, more emphasis was placed on high temperature problems than on any other. Design and operating problems inherent in high temperature operation of pneumatic components, hydraulic components, packings, filters and the intensified search for a satisfactory high temperature hydraulic fluid, took up a considerable part of the discussion time.

Information for operation at temperatures above the present spec (160F) was asked by the chairman of the Pneumatic Sub-Committee of A-6, A. H. Hobelman of Walter Kidde & Co. Discussion brought out that the Air Force is testing systems and components up to 410 F and that a contract has been let to Douglas Aircraft Company for tests of hydraulic components at high temperatures.

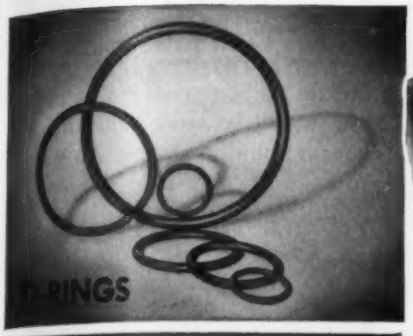
Pneumatic Check Valve Specification

Discussion developed that this spec is now at BuAer, who will coordinate it with the Air Force. BuAer stated that this spec would be issued as a MIL-(Aer) spec very shortly.

BuAer is also issuing the Pneumatic Control Valve spec. The chairman assigned to A-3 Committee the job of incorporating 1/8 inch line fittings in an A-3 spec for coordination.

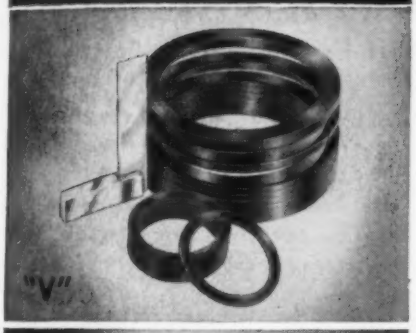
MIL-P-5518 Pneumatic Systems, Design, Installations and Tests in Aircraft

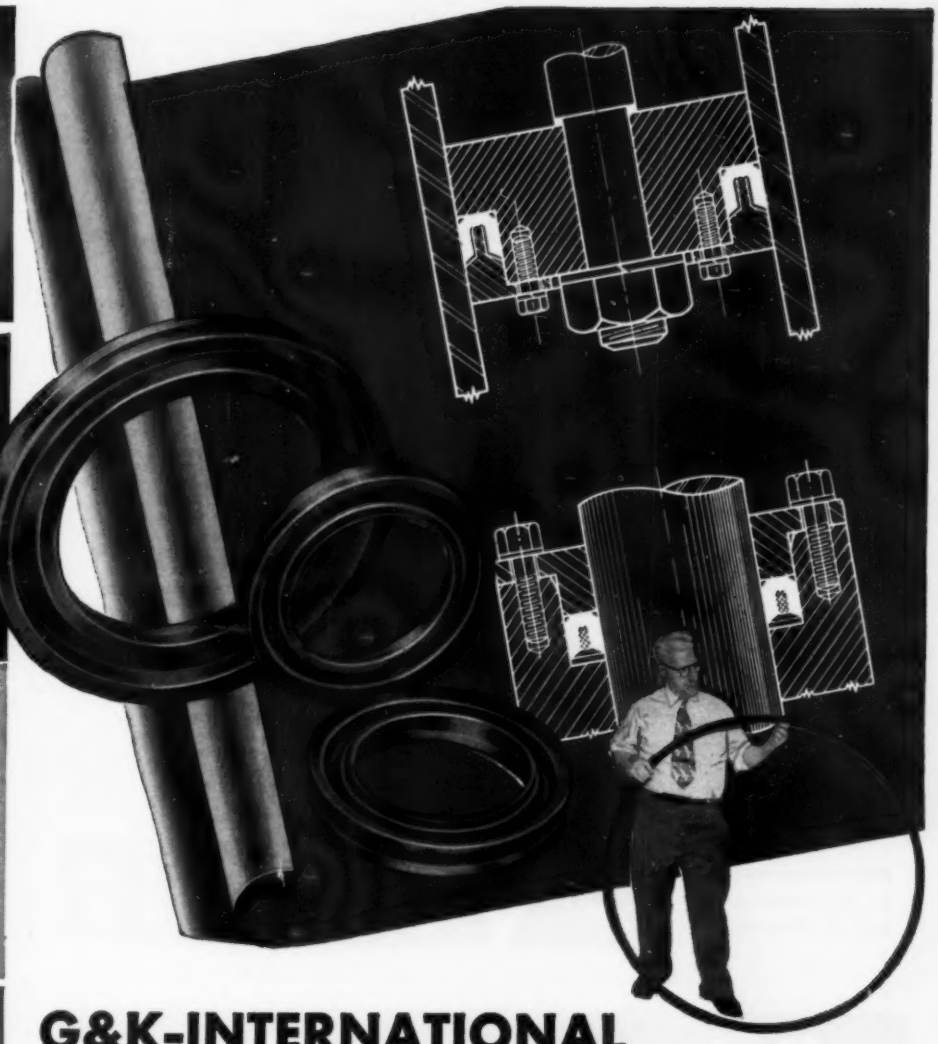
Discussion developed the need for a larger 3000 psi compressor for ground charging of pneumatic services for aircraft. It was generally



U-PACKINGS

Made of leather or rubber. A completely mechanical seal installed in recess on cylinder wall or piston head. Sealing lips and side walls form dynamic seal inside and outside. Pedestal ring or filler required for best service. Expanders also adaptable when needed.





G&K-INTERNATIONAL can supply your packings needs—

standard or special — leather or rubber

With one entire plant specializing in packings design and manufacture, G&K - INTERNATIONAL offers a staff of technical experts with the latest in modern equipment and quality controls, backed by experience gained over 50 years in this field.

Whatever your packings requirements (Original Equipment or Replacement) you can bring them here with the assurance that you will get just the right packings. We work in both leather and rubber, and can fill orders on the basis of installation needs. For example, leather U packings are manufactured in sizes larger than those contained in the JIC tables — some as big as 6 feet in diameter!

To be sure that you get the *right* packings — *and on time* — *specify* G&K-INTERNATIONAL!

New Packings Catalog
Probably the most comprehensive catalog and manual in existence today. Covers all types, with latest tables. Also useful application information. Write for it — you ought to have a copy.

G&K GRATON AND KNIGHT INTERNATIONAL

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Established 1851
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INTERNATIONAL PACKINGS CORPORATION
Graton & Knight Company Affiliate
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P-4

Circle 128 on Reader Service Card

Diversatility Defined...

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Designers, Engineers, Plant Managers . . .

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Complete line of pilot solenoid valves for every requirement.

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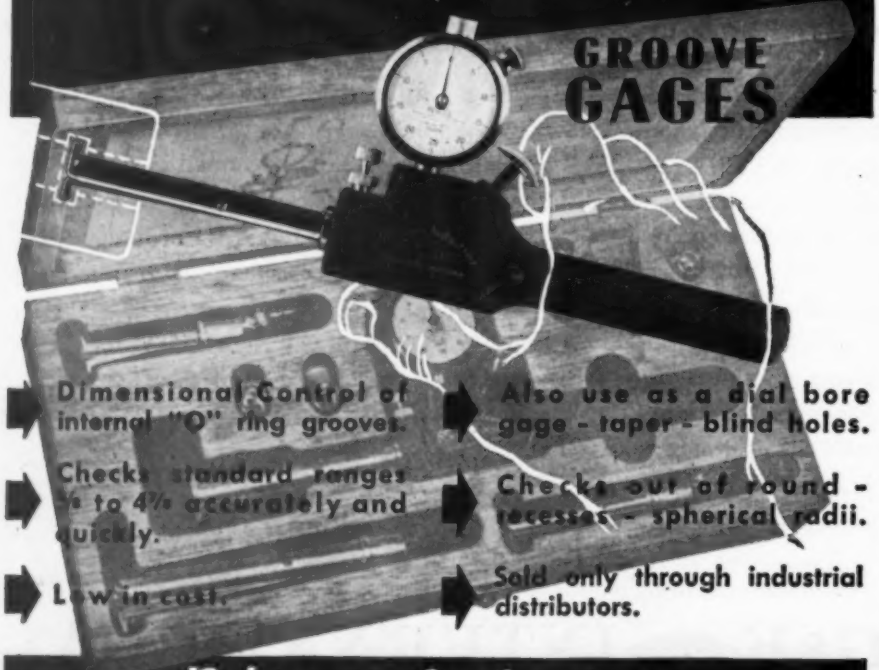
Rely Upon Valvair — 2-WAY — 3-WAY — 4-WAY

Reliant "O" Ring

GROOVE GAGES



- Dimensional Control of internal "O" ring grooves.
- Checks standard ranges ⅛ to 4⅞ accurately and quickly.
- Low in cost.
- Also use as a dial bore gage - taper - blind holes.
- Checks out of round - recesses - spherical radii.
- Sold only through industrial distributors.

Reliant Industries
4947 FIRESTONE BOULEVARD
SOUTH GATE, CALIFORNIA

Aircraft Committee

agreed that a compressor of at least 12 cfm would be needed for carrier deck or ground charging. No such compressor is now available commercially

Pneumatic "O" Ring and Seal Experiences

It developed that some trouble has been experienced in high pressure pneumatic systems with MIL-P-5516A "O" rings. Cornelius reported good initial results with Quad rings. Republic reported fairly good results. Lockheed reported very fine, almost microscopic lint on some rings, that, when cleaned off, the rings gave good results. North American blamed small surface imperfections for "O" ring leakage.

MIL-V-5523, Hydraulic Pressure Relief Valve

Adel reported on the results of a survey, the gist of which was that the internal adjustment was not satisfactory. The chairman reported that the spec was being routed to the services. Sprague Engineering & Sales reported on the status of MIL-A-5498, Aircraft Hydraulic Pressure Accumulators.

MIL-F-7083 (Aer), Hydrolube H-2

BuAer reported a number of recent developments, including a number found in service conditions in Korea. Corrosion was emphasized as the most common problem encountered. Many components, especially single acting whose parts were alternately exposed to the atmosphere, had corroded. In most cases the corrosion was not serious. Several aircraft builders reported on their experience with H-2. Douglas, El Segundo, stated that H-2 had not been satisfactory and that their own tests indicated that corrosion would continue to be a serious problem. North American recalled the West Coast aircraft meeting recommendation. Chance Vought reported general but not serious corrosion with most trouble with brakes at high temperatures. Objections pointed out included the "dirt sensitiveness" of H-2, its greater weight by volume than red fluid and that it has a definite tendency to pick up and hold air, the latter causing fan buzz and fanning of gauges.

Circle 103 on Reader Service Card

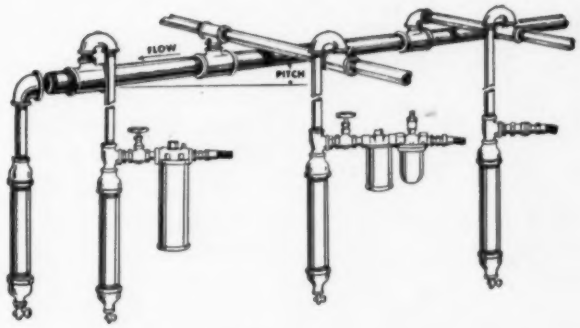
To Avoid Air Line Troubles

HANSEN REPRESENTATIVES
Quick-Connective Couplings
Are Their Business
BUT SO ARE FLUID LINE PROBLEMS

GEORGE W. WARDEN
Geo. W. Warden Co., Seattle
Maintains close contact with fluid line installations in plants throughout Pacific Northwest.

EDWARD BURKE
The Burke Co., San Francisco
Offers years of practical experience in handling of vacuums, compressed air, gasses and liquids. Author of engineering manual on aircraft hydraulics.

CHESTER CAUGHRON
Chester Paul Co., Glendale
Supplies pneumatic and hydraulic equipment to practically every type of industry in the thriving Southern California area.



...use the on-the-job know-how of the HANSEN Representative

By the very nature of his job, the Hansen representative is thoroughly familiar with practically every type of air line hook-up. He knows what works—and why it does. Frequently, the remedy for your difficulties, drawn from his experience in dozens of plants, is very simple.

When you need help over the rough spots—either when actual troubles arise, or when air line circuits are being planned or altered—give him a call. Believe us, you'll welcome the help that he can give you.

REPRESENTATIVES

BALTIMORE	DETROIT	NEW ORLEANS
BIRMINGHAM	FT. WAYNE	PITTSBURGH
CHICAGO	HARTFORD	ROCHESTER
CLEVELAND	KANSAS CITY	SAN FRANCISCO
DALLAS	LOS ANGELES	SAVANNAH
DAYTON	LOUISVILLE	SEATTLE
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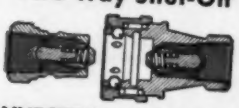
QUICK-CONNECTIVE FLUID LINE COUPLINGS

1. QUICK CONNECTION AND DISCONNECTION
2. INSTANT AUTOMATIC FLOW OR SHUT-OFF

One-Way Shut-Off

Two-Way Shut-Off



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because O-M CYLINDERS air hydraulic

have the lowest coefficient of friction of any cylinder

For efficient performance at low pressure, the O-M Cylinder really stands out! Smoothness of bore (4 to 7 micro-inches), and self-adjusting packing reduce friction . . . floating-cushion nose *eliminate binding, dragging, jerking.* This assures a smoother stroke at low or high speeds.

Every O-M Cylinder is ALL cylinder! *Interlocking* mechanism does away with projecting tie rods and end caps, saving up to ⅓ installation space, and permitting the use of a more powerful cylinder for the job. Easier to install and repack. End plugs tapped for universal mounting, with a complete range of mounting brackets—interchangeable bore for bore. All machined steel, with bearing bronze (no castings)—easily turned down to fit in deep recesses of machines or bases.

14-DAY DELIVERY ON MOST SIZES

Send today for FREE catalog and complete set of ½ and ¼-scale templates showing all cylinders and mounting brackets.

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Lockheed recommended dropping H-2. Grumman, Glenn L. Martin and McDonnell believed that they could go along with H-2 and resolve some of the difficulties encountered in service. The BuAer reported two new fluids received but as yet untested.

High Temperature Hydraulic Systems

Because of the importance of this problem and the necessity of close coordination the chairman appointed an advisory committee of airframe representatives to meet at the call of either of the services. Fred Pollard of Republic, who will act as industry coordinator; Frank Murphy of Douglas, Santa Monica; George R. Keller, North American are the airframe members. E. L. Carlotta, The Parker Appliance Co. and E. N. Cunningham, Precision Rubber Products are the packing representatives; Duncan Gardner, Vickers, Inc. and John W. Kelly, Adel are the accessory members.

MIL-P-5516, Packings and Gaskets

American Airlines reported that Committee A-12 Aircraft Shock Struts had assembled a considerable body of data and that a complete report would be forthcoming. Linear, Inc. reported that there was an apparent need for small size "O" rings (ARP-267). Precision Rubber Products was given an assignment by the chairman to survey the airframe industry regarding a number of new sizes of proposed standard rings for hydraulic systems. A proposal covering changes in MIL-R-521 (backup rings) was presented by the services. Both airframe and the service representatives had previously expressed a preference for spiral teflon backup rings.

Chairman Teree announced that the next semi-annual meeting of Committee A-6 would be held in Washington, D. C. dates to be announced later.

Fittings and Hose Assemblies Report

CHAIRMAN L. J. HENDERSON presided over a one day session of SAE Committee A-3, Aircraft Fittings and Flexible Hose Assemblies at the Lexington Hotel New York on Monday, April 20th. In spite of the fact that the meeting was held concurrently with the meeting of Committee A-1, nearly 100 representatives of the airframe industry, manufacturers and the services attended. A number of reports and discussions on a low profile elbow (AN 833), tests on fire and shelf life of MIL-H-5511 and 5512, packaging of AN tube and pipe fittings, and proposed dimensions of wrench pads for AN 776, 777, 778 and 779 among others filled a busy agenda.

AN 775 Bolt-AN 833 Elbow

A low profile elbow was proposed in place of the banjo fitting. A special swivel elbow and the North American banjo was also considered. Chance Vought proposed a longer bulkhead elbow as well as a low profile elbow. Hughes suggested the use of face seals with banjo fittings. Lockheed reported the latter unsatisfactory as did Republic. Lockheed is to test further and report at the next meeting.

MIL-H-5511 and MIL-H-5512

Aeroquip and Weatherhead reported on continued fire tests on the MIL-H-5511 hose, the latter reporting that CAA had agreed to accept the tests as described for the military services. The BuAer asked that the whole universal hose situation be reexamined. Aeroquip reported on leakage tests of 5511 hose which had been assembled and on the shelf for periods up to 26 months. The results will be plotted and sent to the chairman. Aeroquip made a similar report on MIL-H-5512 hose, -6 size, after shelf life up to 12 months. Hughes reported no difference in test results between new and indeterminite shelf life hose assemblies.

Packaging of AN Tube and Pipe Fittings

Northrop reported that dirt was being introduced into the hydraulic

system from the oil on the fittings; particularly bad were the brake systems. The concensus of airframe opinion was that the primary function of packaging of fittings was to prevent damage and that packaging did not keep fittings clean. Fitting manufacturers recommended that individual packaging should be done after the receiving inspection at airframe plants. The survey will be forwarded through NASC.

Metal Seal

The Aircraft lab reported the development of a new metal seal which is pressurized to fit. Tests prove it will hold at 400 F on air, then at -65 F and back to 400 F. Impulse tests have been made. Further tests will continue.

Pump Committee

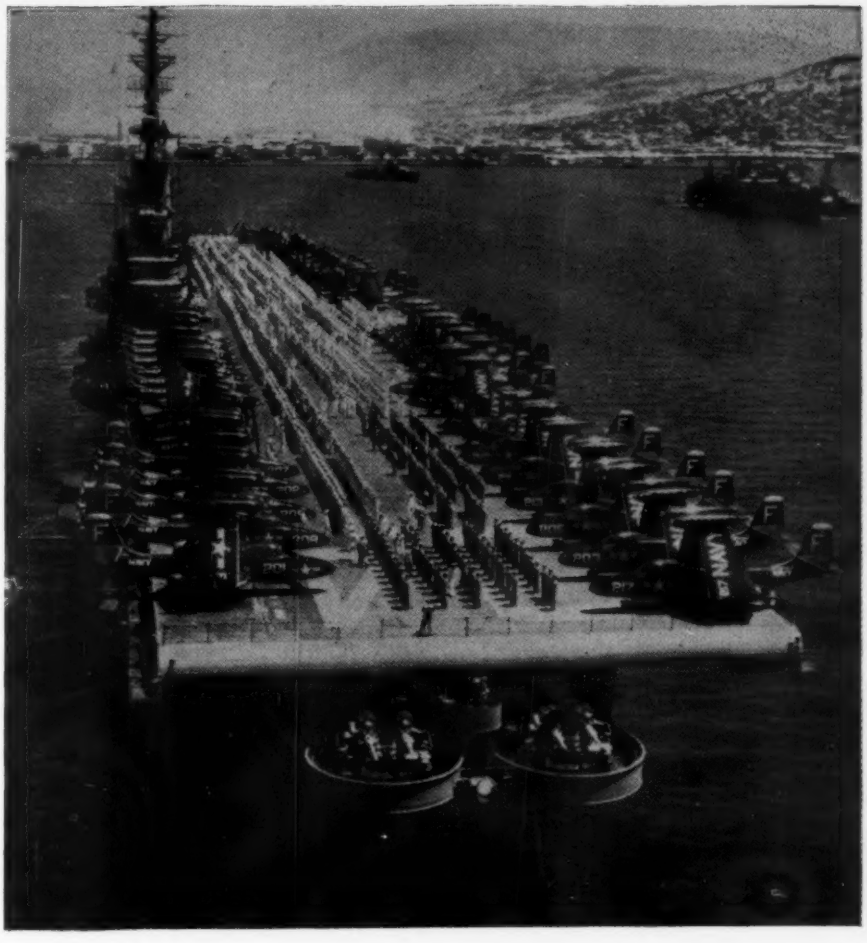
The SAE Committee A-1, Aircraft Pumps, met at the Lexington Hotel, New York, Monday, April 20th. With about 40 representatives of pump manufacturers and the services in attendance, Chairman Kidd presided over a very interesting and profitable session. The most important items discussed were specifications for variable delivery, power driven hydraulic pumps, high speed variable delivery pumps and a preliminary discussion on high temperature hydraulic pumps.

Sundstrand Machine Tool Company reported in detail on two lots of amendments to proposed specification MIL-P-7740, Variable Delivery, Hydraulic, Power Driven Pumps. General agreement was reached on most of the suggested changes. Most of the points resolved around proposed test procedures.

Hamilton Standard reported on proposed changes suggested on the High Speed Variable Delivery Pump Specification under development. The proposed changes, submitted in writing, were discussed at length.

Other items discussed included work on the 5000 psi variable delivery pump specification, sponsored by Denison Engineering Co.; Fuel pumps, reported by Bendix Products and Thompson Products; and a report on the status of the standardization of electric motor driven pump combinations by Vickers, Inc.

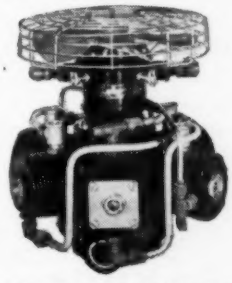
McDONNELL F2H BANSHEES—*Outstanding Navy Fighters*



CORNELIUS PNEUMATIC SYSTEMS
Contribute to the Outstanding Success of

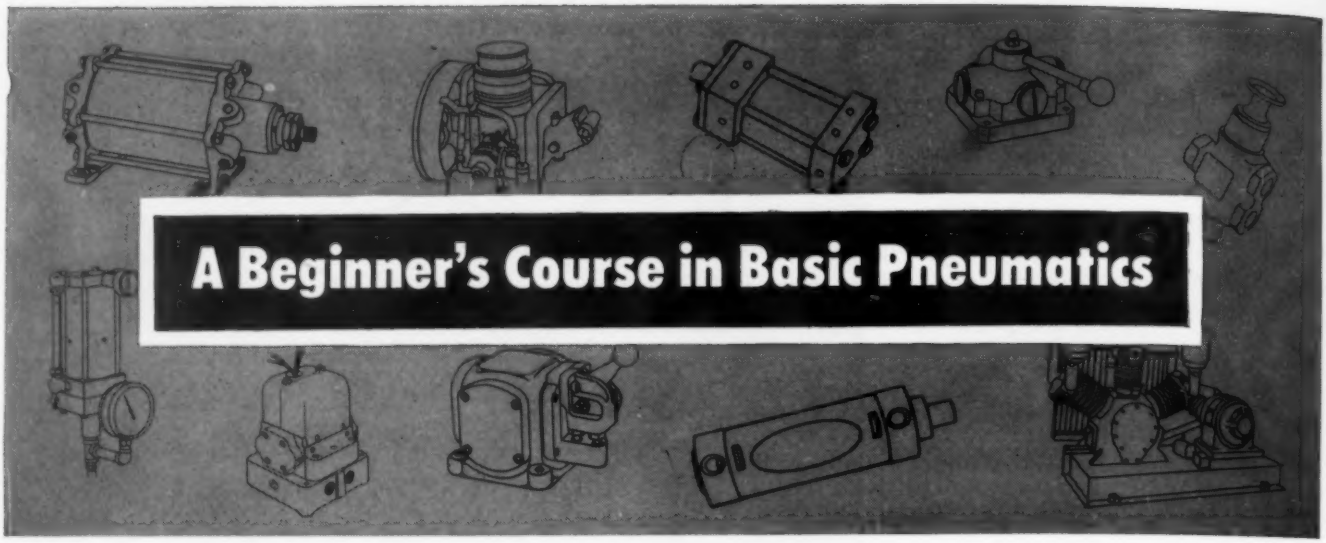
McDONNELL FIGHTERS

McDONNELL has been using Cornelius Air Compressors on all production airplanes since 1948. Constant use, month after month, demonstrates the reliability of Cornelius products. Since 1942 Cornelius has built thousands of high pressure air compressors for the leading aircraft manufacturers, Navy and Air Force. Profit from this experience—write to us about your pneumatic equipment requirements.



CORNELIUS COMPRESSOR
4CFM . . . 3000 PSI
Powered by integral hydraulic motor. Other models available with various pumping capacities. All compressors can be furnished with either hydraulic motors, DC electric motors or AC 400 cycle motors.

THE Cornelius COMPANY
MINNEAPOLIS 21, MINNESOTA
Pioneers in the Development of
AIRCRAFT PNEUMATIC SYSTEMS



Section II The Distribution System

Selection, Storage and Care of Air Hose

Part Eight

Selection

Air hose is available in many types for many classes of work. This makes it possible to choose a hose best suited for almost any specific purpose. When hose must be selected for two or more classes of work or require differing groups of characteristics (e.g., where oil or crushing hazards are high and severe abrasion may also be expected), it is important that the hose selected have design and construction characteristics that will give the user the best possible service life under such diverging sets of operating conditions.

There are some basic factors that must be considered in selecting an air hose. We will give four.

First, the tube should be oil resistant. This is to withstand oil vapor from the compressor or for lines in which tools are oiled through the hose line. Second, the carcass or the walls of the hose should be amply strong for the intended service. This should include strength to withstand the highest pressures anticipated and construction to resist heavy impacts and shock blows. Third, the cover should be rugged to withstand hard abrasive wear as well as the effects of oil and the actinic rays of the sun. Fourth, the hose selected should be flexible and easy to handle. Hoses vary considerably in their flexibility and non-kinking qualities.

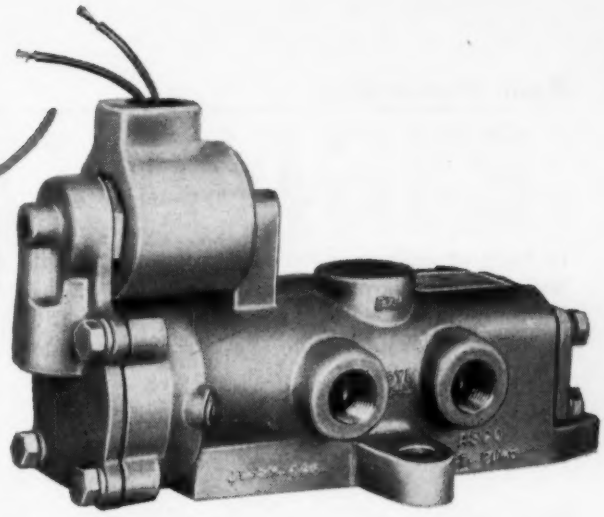
"Store coiled hose on flat surface"

Storage

If a hose is to be stored for any appreciable length

Announcing

The New "Super-Duty"
4 Way Poppet Type
High Speed Solenoid Valve
Produced by ASCO



Headquarters for Solenoid Valves and Electromagnetic Controls

Type

4 Way Valve, Screwed Pipe Connections or Manifold Mounting. Available for 5 ported operation and regulated flow control.

Use

Controlling Ultra High Speed Double Acting Pneumatic or Hydraulic Cylinders.

Operating Speed with Air, 500 Cycles/Minute Continuous; 750 Cycles/Minute Intermittent.

Design Features

- **Instantaneous Action.**
- **Poppets on Common Shaft operated by line pressure inherently provide simultaneous valve action and tight seating.**
- **Differential Piston provides power operation in both directions. Eliminates all danger from sticking.**
- **Short Strokes; Guided Inserted Seats; Minimum Wear.**
- **Packless Construction—No Stuffing Boxes or Sliding Glands.**

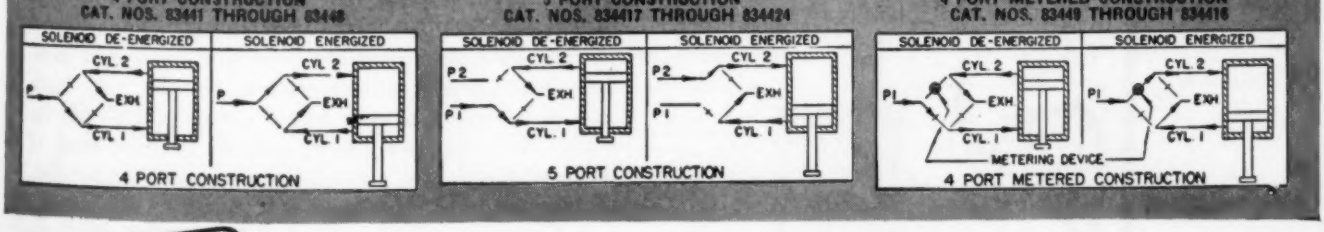
This Solenoid Valve has been thoroughly tested at High Speed for millions of operations.

This Valve (Bulletin 8344) comes with mill type construction, corrosion-resistant bronze body and stainless steel seats and discs. Four standard sizes are available; ⅜, ½, ¾, and 1 inch. The compactness of the Valve is indicated by the dimensions of the largest (1 inch) unit; length 11½ inches, width 5⅜ inches, height 5 9/16 inches. The standard solenoid is suitable for NEMA Type IV Watertight and for Underwriters' Class 1, Group D, Explosion-Proof (NEMA Type VII) requirements. Standard valves suitable for pressures up to 250 psi, may be adapted to higher pressures, if required.

In writing for prices, delivery, and other information, tell us about your control problem. We have many other varieties of standard Solenoid Valves, and engineering facilities for designing special types should you need them.

We manufacture a complete line of standard and specialized Electromagnetic Controls. These include Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and complete Control Panels.

FLOW DIAGRAMS



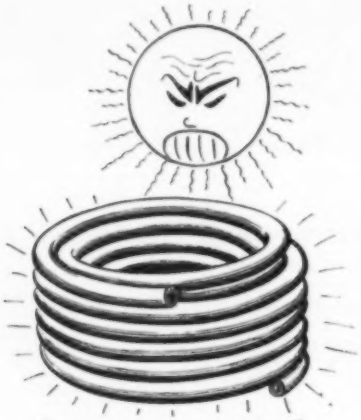
ASCO Solenoid VALVES

"Serving Industry For Sixty-Five Years"

Automatic Switch Co.

385-H LAKESIDE AVENUE, ORANGE, NEW JERSEY

of time before use, it should be stored coiled flat in a cool, dry room. Air or any type hose should never be hung on nails or sharp edge shelving that will cause hose to bend sharply or place local stress on the hose. Various rubbers, including synthetics, will set or permanently deform, causing cracks or weak spots when



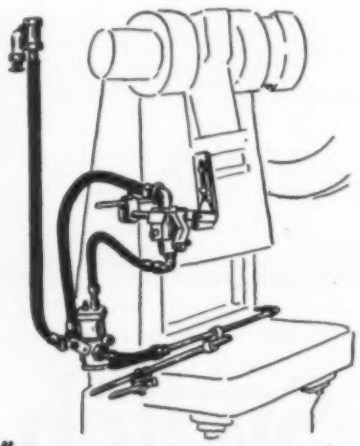
"Sunlight ages rubber"

the hose is subsequently straightened out under pressure.

Hose should be kept away from direct sunlight and high temperatures which tend to harden and crack the rubber in the hose and seriously shorten the service life. The effect of sunlight, due to the actinic rays, is to accelerate normal aging of the rubber by deadening the resiliency of the rubber. The effect is roughly similar to the burning effect of strong sunlight on the skin; the effect on rubber is to char and crack the surface.

Excessive heat will also harden and crack the rubber in hose, seriously effecting service life.

No type of hose should be stored near generators or electric motors. Even a minute amount of ozone has an extreme oxidizing effect on the rubber components in hose, abnormally aging the whole hose structure.



"Enough hose to make natural loops"

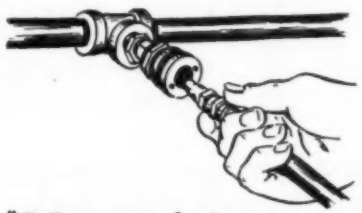
Care

Check all hose lines at regular intervals for evidence of abuse and excessive wear. Most costly breakdowns can be prevented by regular inspection.

Air hose should be connected to air outlets from the bottom, so that the hose will hang naturally without sharp bends, which often break fabric reinforcement inside hose between tube and cover.

When hose is to be idle for a long period, the air pressure should be shut off at the compressor. Heat in air lines in service can be minimized by keeping the air compressor and aftercooler in good repair. Excessive hot oil in air lines caused by accumulation in the compressor is frequently the cause of air hose destruction. Since hot oil will swell most rubber, the tube may buckle inward, breaking adhesion from the carcass, which will either crack it open or make it porous. A periodic checkup of air compressors and drawing off of excessive oil are good practices.

Hose lengths should be turned end for end at intervals for alternate positions of greatest exposure to oil and heat. This will also add to the service life



"Follow manufacturers recommendations on fittings"

of lengths of hose when one end is flexed more than the other end.

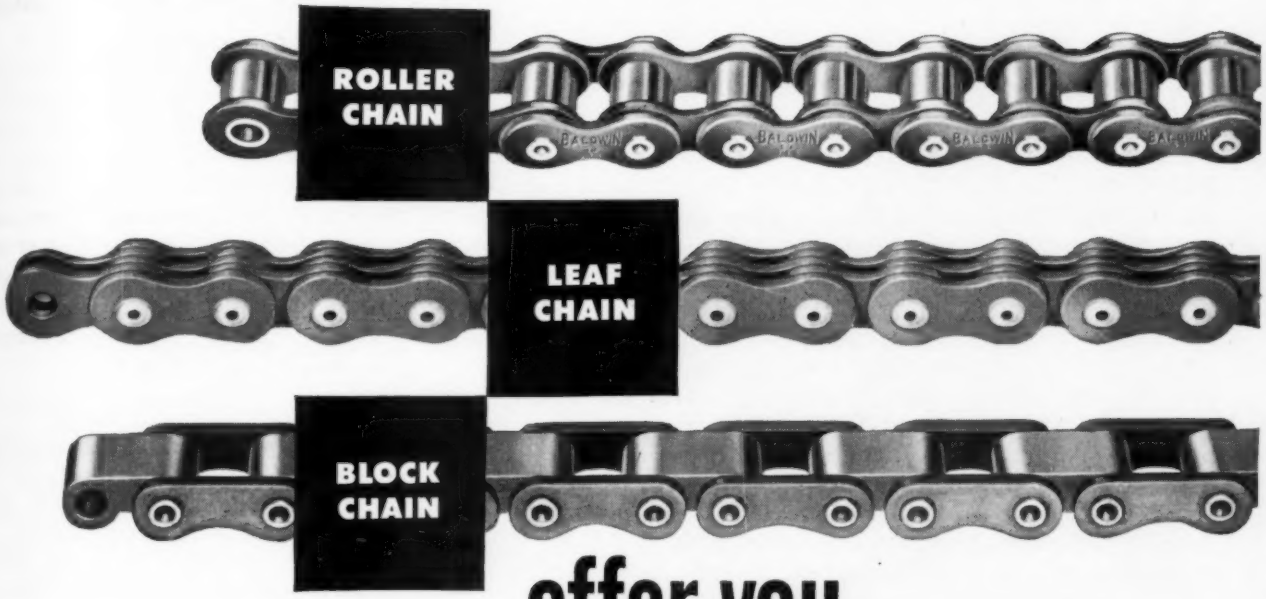
Hose should be of sufficient length to make a natural loop between fixed connections. This will lessen the danger of the shank of the fitting cutting into the hose carcass. In some applications it may be unavoidable to prevent flexing or constant strain at some fittings.

Use recommended, well designed types of fittings for all hose connections. Check fittings regularly, especially for tightness. When hose ends have been damaged by clamps or deterioration, cut the hose back to a point where a new, sound connection should be made. However, this cutting should only be done if the new length still gives adequate length. Otherwise, replace the hose.

Follow the hose manufacturers' recommendations for types of couplings to use. Proper installation of the correct coupling is important to hose life. The greatest strains and tensions, as well as the greatest amount of wear occur at the hose ends where couplings are applied.

The next installment will begin section 3 *and introduce air cylinders.*

for TENSION LINKAGES



offer you these 4 big advantages!

1 Chains are basically designed to flex over sprockets or sheaves. Bearing surfaces are finished and hardened, and relative movement is confined to these specially prepared surfaces. Flexure in a cable imposes severe surface friction between wire surfaces and internal bending of wires. Even where flexure in more than one plane is required, universal clevis connections between sections permit the use of chains.

2 Chains can be *lubricated* much more easily and effectively than cables.

3 *Chain installation* is simple. Connectors are easy to attach and to remove. Cable connectors are difficult to attach, and, since they usually depend on friction clamps, require frequent inspection and tightening.

4 *A chain meshed with a sprocket* provides positive translation of linear motion to rotary motion. Such positive action is impossible between a cable and a sheave.

Our Tension Linkage Booklet is full of useful information on tension linkage selection and application. It contains detailed tables of strengths, weights and dimensions. You'll find it a helpful handbook in your daily work. Use the coupon to send for your free copy today.

Chain Belt Company 52-403
399 Plainfield Street
Springfield 2, Mass.

Send me my copy of Bulletin No. 51-10 covering Tension Linkages.

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Continued from page 30

ELECTRIC MOTORS . . . A folder offered by the Reuland Electric Company describes the motors' construction features which assure dependable service. Stator windings are permanently protected through a series of special processes, against vibration and consequent abrasion and fracture. Also featured in these motors are a positive ventilation system, sealed ball bearings, rotor bars, end rings and fan are a one-piece pressure-cast aluminum unit, and all materials used are pre-engineered for the use they are to fulfill. The motors are designed and built to meet NEMA dimensional and electrical standards, and every motor is thoroughly tested.

Circle 183 on Reader Service Card

STRAINERS . . . Screen strainers in models to handle from 20 to 700 gpm are described in a bulletin sheet prepared by Blackmer Pump Company. The strainer, a metal mesh basket is fitted in a rugged housing and is easily accessible for cleaning.

Circle 184 on Reader Service Card

PUMPS AND MOTORS . . . Positive displacement pumps and motors are described in a booklet offered by Deri Engineers Ltd. Made in models developing up to 2500 psi and handling up to 100 gpm, these power units have a unique construction. A diagram shows the double cam rotor design. Sizes are tabulated and graphs plot power ratings for each model.

Circle 185 on Reader Service Card

TUBE FITTINGS . . . Catalog No. 344-D features Flex fittings manufactured by the Imperial Brass Mfg Co. These fittings, for connecting tubing where there is major vibration or minor tube movement, incorporate a sleeve of special synthetic elastic material which permits the tube to flex back and forth and at the same time assures a positive pressure-tight seal. The booklet states that the joint is virtually indestructible by vibration and will withstand considerable mechanical shock; in many instances eliminates the need for costly flexible hose lines, and can be used with all kinds of metal tubing, seamless or seamed. It is easy and speedy to install and can be disconnected and reconnected repeatedly without danger of leakage. The booklet is well illustrated showing the various types available, their specifications and recommended maximum service pressures. Several applications are shown.

Circle 186 on Reader Service Card

HYDRAULIC VALVE . . . Used for rugged hydraulic power applications on road, mining and earth moving machinery, the A. W. Cash Company's four-way valve is described in Bulletin S-600. A cross-sectional drawing details the rotary spool construction of this 1500 psi valve. The valve includes a relief valve to protect the system from overload and a check valve to provide positive locking of the load.

Circle 187 on Reader Service Card

INDUSTRIAL AND AIRCRAFT VALVES . . . Republic Manufacturing Co. has published a 44-page comprehensive valve catalog, No. 352 A, describing valves for use in a variety of applications in hydraulics, lubricating, air, chemical and other lines, and meeting a wide range of pressure, temperature and corrosion conditions. Globe, needle, plug, check, relief and special valves are featured in well layed-out sections. Each valve listed in the book is fully explained and illustrated with photographs and sectional drawings; construction features are highlighted and all construction data, working pressures, operating temperatures, port threadings and recommended applications listed. This booklet should be a useful addition to the design engineer's library.

Circle 188 on Reader Service Card

GEAR PUMPS . . . Catalog 100 describes Tuthill Pump Company's internal gear pumps for low pressure applications. The pumping principle is illustrated and a pump guide chart helps to select the type of pump for required service. Tabulated in this chart are operating data which includes pump capacity, speed and pressure, packings, pump mountings and a group of pump features.

Circle 189 on Reader Service Card

TRIPLEX PUMPS . . . Designed for pressures to 5000 psi, American-Marsh triplex pumps are described in Bulletin 295. Built in three models having 1½, 2 and 2½ inch strokes, the pumps will deliver a range of capacities from 1.1 to 16.5 gpm. Complete dimensional data is tabulated and a sectional drawing shows the direct drive construction of these horizontal piston pumps.

Circle 190 on Reader Service Card

LIQUID LEVEL GAGE VALVES . . . A set of nine data sheets covering a complete line of liquid level gage valves for both tubular and flat gages, regular, offset and with minor connections to gage, are offered by Jerguson Gage & Valve Company. Complete specifications with illustrations, showing cross-sections, and dimensions. Standard and optional connections are also given.

Circle 191 on Reader Service Card

V-BELTS . . . High-capacity belts for tough jobs are described in bulletin prepared by Allis-Chalmers Mfg. Co. The bulletin states the V-belts carry 40 percent greater horsepower rating, are oil resistant and static conducting. They are recommended for use in tight spots, for compactness, changed peak loads and where static is a factor.

Circle 192 on Reader Service Card

PLUS VALUE in Air Cylinders

Designed and constructed to J.I.C. standards, NEPTUNE-POWER PLUS air cylinders are available in seven standard mountings for air powered applications to 200 P.S.I.

- Standard bores from 1 to 14 inches.
- Large bores and strokes made to customer specifications.
- Single or double end rods with adjustable or self-regulating cushions.
- Other series built for water and oil service to 3000 P.S.I.

Write for Catalog AH

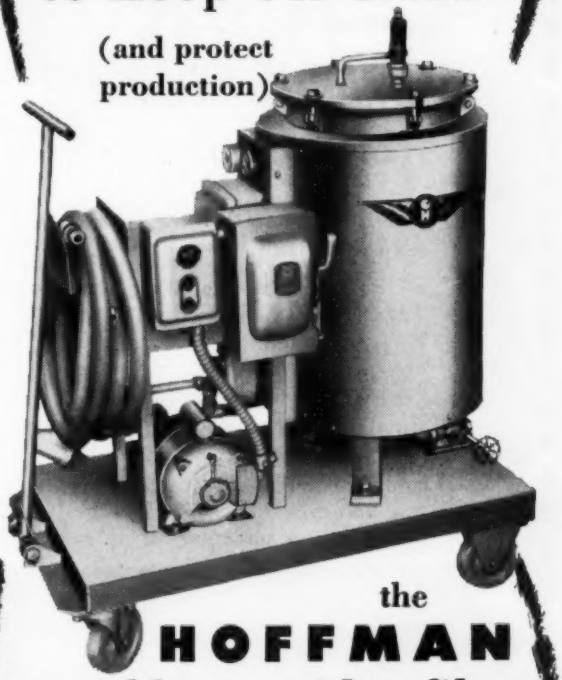
Write for Catalog AH

NEPTUNE-POWER PLUS PRODUCTS CO.

2228 Bellevue Ave. Detroit 7, Michigan

GOES ANYWHERE to Keep Oil Clean

(and protect production)



the HOFFMAN portable cartridge filter

Fills the need for periodic, scheduled filtration of oils where quantity does not warrant separate, continuous filtration. Easily moved from one machine to another. Flexible hose with quick connecting couplings attaches to the oil supply of the machine. Operates on a recirculation basis for such time as is required to fully recondition the oil.

For use on hydraulic oils (hydraulic presses, hydraulic machine tools, injection moulding machines, die casting machines) and quench oils. Two sizes: 30 and 60 g.p.h. capacities for repackable or throwaway cartridges. Fuller's earth or cellulose.

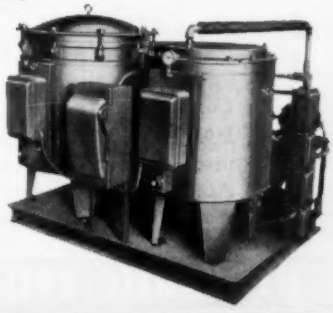
Write for Bulletin A-916 today.

For Complete Purification of Used Oils —

HOFFMAN OIL CONDITIONER

25 to 600 g.p.h. capacity
Removes solubles and insolubles

Write for free Bulletin A-667



TOPS IN VALUE SINCE 1905

Hoffman

INDUSTRIAL FILTRATION EQUIPMENT & SERVICE

U. S. HOFFMAN MACHINERY CORP., 239 LAMSON STREET, SYRACUSE 6, N. Y.

In Canada: Canadian Hoffman Machinery Co., Ltd., Newmarket, Ont.

Pathon

Series RH 2000 P. S. I.

HYDRAULIC CYLINDERS

offer you

MORE

DURABILITY—On all applications Pathon RH Series Cylinders offers you a "Plus Factor" in durability—you get greater fatigue life . . . less maintenance trouble—**and extra capacity for shock loading.**

COMPACTNESS—The use of a single screw thread for attaching heads to barrels, eliminates the bulkiness inherent in keeper-ring and bolt-type cylinders. You get maximum strength in a minimum of space.

Pathon Series RH Hydraulic Cylinders are available in capacities up to 3000 P. S. I.—for special application.
Write for Bulletin #17
The cylinder selector will help you specify the exact characteristic you want in choosing your Pathon Series RH Hydraulic Cylinder Assembly—

PATHON VALVES—We offer you a complete line of Hydraulic Remotely Operated Directional Control Valves.

PATHON PNEUMATIC CYLINDERS — We manufacture seven standard models of Double Acting Air Cylinders which will meet the great majority of your requirements.

HYDRAULIC CYLINDERS—VALVES

Pathon

MANUFACTURING CO.

3821 Pacific Ave.
Cincinnati 12, Ohio

USEFUL LITERATURE

HOSE ASSEMBLIES . . . Carlyle Rubber Company offers an 8-page catalog on industrial hose assemblies. A complete line of hydraulic hose assemblies, fabricated to customers length and coupling specifications are available from factory stock. Designed to include the most complete range of hydraulic hose applications, made in two basic constructions, medium pressure and high pressure assemblies. The high pressure for 2000 to 5000 psi is of two wire braid construction, medium pressure for 800 to 2000 psi has one wire braid construction. Coupling combinations and specifications are tabulated. Also covered in the catalog are vari-purpose, lubrication, paint and solvent spray assemblies.

Circle 193 on Reader Service Card

OIL HYDRAULIC CYLINDERS . . . A new bulletin, No. 52-55, has been issued by Vickers Incorporated, covering their line of oil hydraulic cylinders. This 32-page multi-colored brochure replaces Bulletin 49-55, and has been brought up to date. Featured are all the various models and mounting styles, each illustrated. Included in this new edition is data for the barrel type trunnion mounting, which now shows minimum locations of the trunnion in relation to the end cap. Also given are dimensions for the piston rod knuckle of the new design. Engineering data, installation suggestions, flow control and metering circuits are outlined.

Circle 194 on Reader Service Card

CONTROL INSTRUMENTS . . . The Bristol Company has published a bulletin sheet W 1805, listing all products made by the company. Included are temperature control devices, air operated controllers, flow meters and other automatic control instruments. Individual bulletins are available for each of the listed products.

Circle 195 on Reader Service Card

HYDRAULIC PUMP . . . American Engineering Company has published a bulletin on the new Hele- Shaw JHP 30 pump. The bulletin tells that this new pump was engineered to meet three important demands: for a variable displacement pump of over 100 gpm capacity; a pump with a pilot pump attached to eliminate a second drive; and for hydraulic controls instead of mechanical type. All these features are incorporated in this pump and discussed in this bulletin. Sectional drawings are shown and a part list given. All specifications are detailed and the recommended applications listed.

Circle 196 on Reader Service Card

COUPLING FOR METAL TUBING . . . The Sealastic all-purpose fitting manufactured by the Chicago Forging and Manufacturing Co. is described in a 12-page brochure. A cross-sectional photograph shows the construction features responsible for the shock absorbing and vibration-fatigue proof characteristics. The separate parts are illustrated below the cross-section in their relative position within the assembly. There is no metal contact between tube and fitting. This fitting offers wide application for every industry

Circle 197 on Reader Service Card

PACKINGS . . . Felt Products Manufacturing Co., Packing Division has prepared a catalog on packings. For petroleum products the company features type HP, an improved high pressure seal, designed and built to meet the extraordinary sealing requirements of equipment handling hydrocarbons under high pressures and temperatures. It will handle pressures up to 600 psi and temperatures up to 250 degrees F. Also covered are reinforced V packings for both adjustable and non-adjustable glands. These packings are furnished in sets or as individual rings. Male and female adapters are normally supplied when sets are specified. The catalog is well illustrated and various packing styles listed.

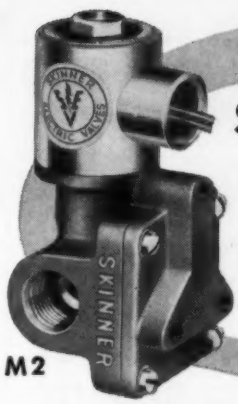
Circle 198 on Reader Service Card

Circle 111 on Reader Service Card

SKINNER

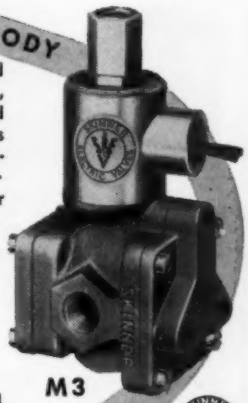
Solenoid Valves

for air & hydraulic cylinders
fluid shut-off
diaphragm operated
equipment
coolant control



M2

BRONZE BODY



M3

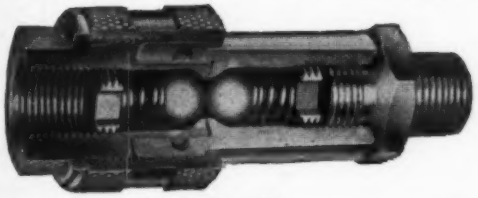
"M" SERIES pilot-operated Skinner Valves have extremely fast action, and large capacity on air, inert gas and liquid applications. All internal metal parts are stainless steel or brass. Soft seals prevent leakage — operate in any position — rubber coated, nylon fabric diaphragm for long life — port size ¼" or ⅜", orifice ⅜" — power consumption, 10 watts — continuous duty.

M2 is two-way, normally closed, 5 to 150 p. s. i., weight 3 lbs. **M3** is three-way, normally closed, normally open, or directional flow, 20 to 150 p.s.i., weight 3¾ lbs.

Write for Bulletins No. 493 & 494

Skinner ELECTRIC VALVE DIV.
THE SKINNER CHUCK COMPANY
105 Edgewood Avenue, New Britain, Connecticut

HYDRAULIC and PNEUMATIC QUICK COUPLERS THAT DO THE JOB!



Model 3000

- Guaranteed not to leak
- Amazing free area
- Easy to couple and uncouple
- High quality—Low Cost
- Sizes: ⅜", ½", ¾"

Model 4000

Pressure Ranges

Model 3000—Zero to 30,000 psi for burst. (for operating pressures up to 15,000 psi)

Model 4000 and 5000—Zero to 10,000 psi for burst. (for operating pressures up to 6,000 psi)

Models 4000 and 5000 easily converted to "Break-away" types by using our Break-away Clamp.

Dust Plugs and Caps available for all Couplers

Please write for complete Literature

Model 5000

Pioneer Hydraulics, Inc.
121 No. 1st St. Minneapolis 1, Minn.

AIR-HYDRO-PUMP

produces and holds

27,200 PSI

Hydraulic Pressure
(air required—100 lbs. psi)

- Air-Hydro-Pump is the world's finest pressure unit for rapid testing of Valves, Boilers, Piping, Pressure Vessels.
- Sustains constant pressure on Rolls, Rams, Presses.
- Portable for site testing.
- Water, Oil, Diluted Alkalis and Acids can be used.
- Made of non-ferrous metals.
- Fully automatic, holds any pressure indefinitely.
- Complete range of 34 models single or double acting.

High Pressure Control Valves to 30,000 p s i Also Available

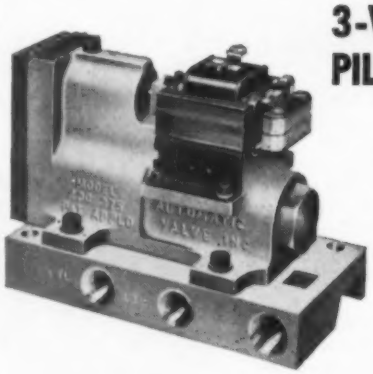
WRITE FOR DETAILS

DAVIES BROS. 120 WALL STREET NEW YORK 5, N. Y.

PUMPS FOR EVERY ENGINEERING NEED

Fast-Rugged-Dependable

AV AIR CONTROL VALVES



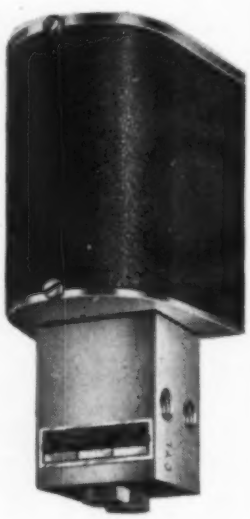
3-WAY..4-WAY PILOT OPERATED VALVES

Short operating stroke gives exceptionally high speed performance.

Uses small, low-power, nationally-known solenoids.

Small, compact, made with non-corrosive materials. 3-way (norm. open or closed) and 4-way operation full port sizes ¼", ⅜", ½" and ¾".

3-WAY... 4-WAY SOLENOID OPERATED PILOT VALVES



Direct acting—¼" pipe tap for pressures to 150 P.S.I.

Light aluminum construction.

Operates master valves, or small cylinders up to 3" in diameter.

SPEED CONTROL VALVE

Efficiently controls speed of piston rod of cylinder. Restricts air being exhausted from cylinder.

Used on air or hydraulics —pressures to 1200 P.S.I.

Sizes ¼", ⅜" ½" and ¾".

Write for bulletin and attractive O.E.M. and quantity discounts

AUTOMATIC VALVE CO.
37419 Grand River Ave.
FARMINGTON, MICHIGAN

USEFUL LITERATURE

V TYPE PACKINGS . . . James Walker Packing Company, has published an attractive, illustrated leaflet on a packing for shallow stuffing boxes. The leaflet describes Shallex Packing which is normally supplied in sets composed of a succession of V shaped rings complete with male and female adapters. The rings can be split or endless as required. These packings, designed for use on vertical or horizontal reciprocating shafts or rams, are made of material suitable for a very wide program and temperature range. They are recommended for most types of hydraulic presses, piston head, main ram, and drawback rams, particularly where packing depth is restricted, hydraulic jacks and various other cylinder applications. Also given are fitting notes and charts of recommendations for standard size, depth, and number of rings in relation to shaft diameter and pressure.

Circle 202 on Reader Service Card

CONTROL VALVES . . . The Denison Engineering Company prepared Bulletin sheets VRD 1-8 on control valves, which include direct operating relief valves, direct operating sequence valves, direct operating sequence valve with built-in check, remotely controlled, and direct operating counterbalance valves. All valves are available in threaded body type, subplate and flange types, for pressures up to 2000 psi. The sheets are well illustrated and all specifications listed. An additional feature is a typical circuit illustration for each of the valves described.

Circle 203 on Reader Service Card

OIL FILTERS . . . Marvel Engineering Company has released its new 12-page illustrated catalog, No. 106. Given are all the latest information and improvements in the Synclinal filters for hydraulic oils, coolants and lubricants. Cutaway drawings, parts lists, dimensional charts, engineering data, typical installations, actual mesh sizes and flow and pressure drop tables are shown.

Circle 204 on Reader Service Card

QUICK-DISCONNECT COUPLERS . . . Basic design and performance data of quick disconnect couplers are given in a brochure issued by the Bruning Company. All that is necessary to couple or uncouple hydraulic lines with this coupler is a slight sliding movement of the locking collars on the coupling sleeve assembly. Listed are several series of couplers and their construction features are illustrated. This brochure also contains some data on air and hydraulic cylinders manufactured by the company.

Circle 205 on Reader Service Card

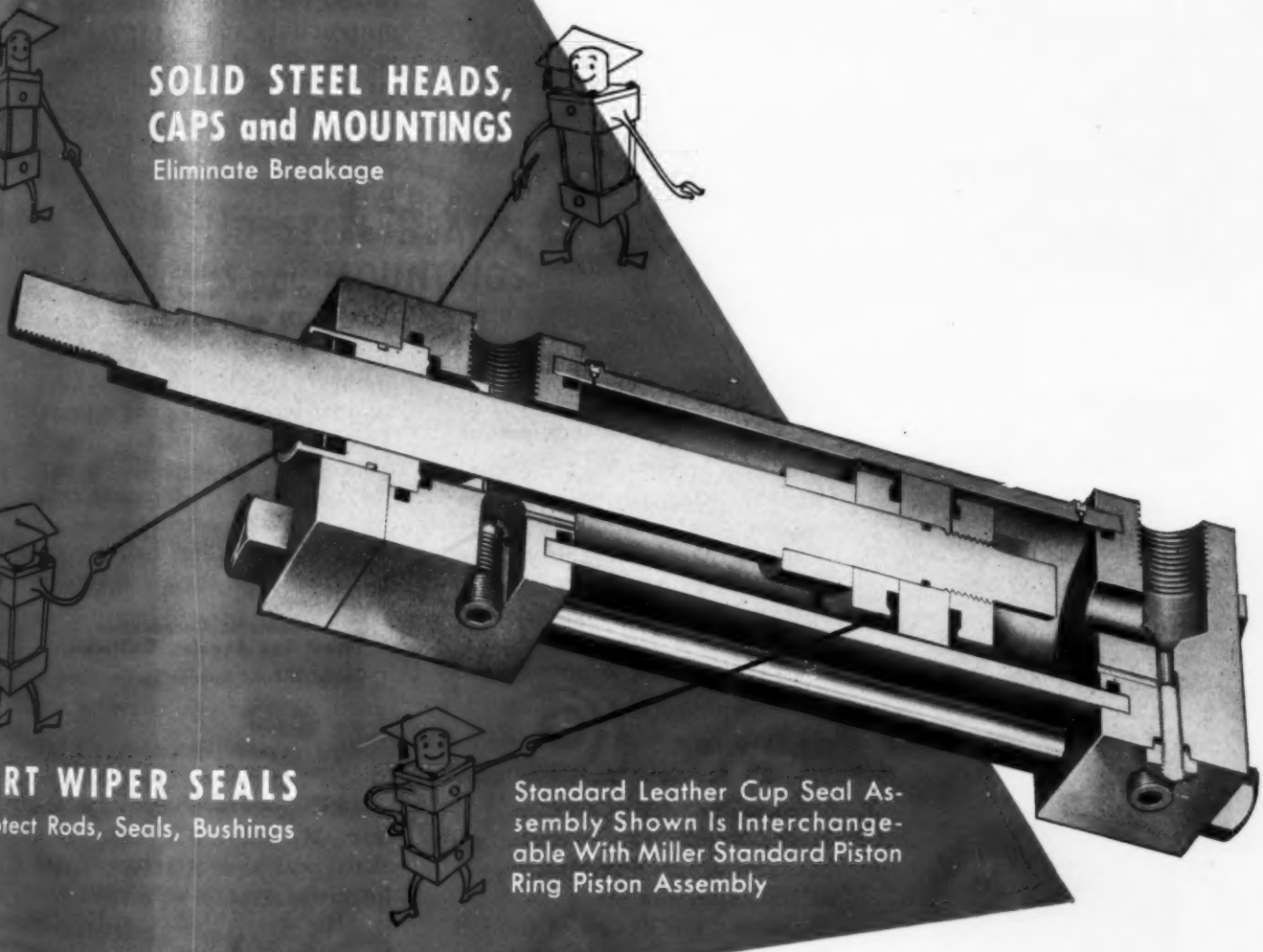
Circle 11 on Reader Service Card

Circle 68 on Reader Service Card →

Miller HIGH PRESSURE HYDRAULIC CYLINDERS

HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage



DIRT WIPER SEALS
Protect Rods, Seals, Bushings

Standard Leather Cup Seal Assembly Shown Is Interchangeable With Miller Standard Piston Ring Piston Assembly

WRITE FOR CYLINDER BULLETINS H-104 and A-105

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

MET J. I. C. HYDRAULIC STANDARDS years before their adoption in 1949.

SPACE-SAVING SQUARE DESIGN originated by Miller in 1945.

SALES AND SERVICE FROM COAST TO COAST
CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

Miller

MILLER MOTOR COMPANY

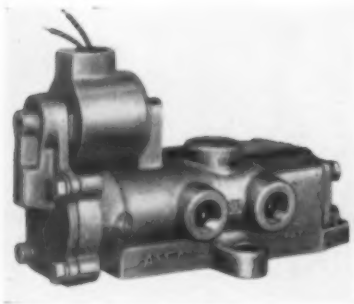
2008 N. HAWTHORNE AVE., MELROSE PARK, ILL.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

Continued from page 28



POPPET TYPE SOLENOID VALVE

. . . for high cycle speeds

Design: Poppet type, bevelled stainless steel seats and discs. Guided, inserted seats (no threads) provide perfect alignment and tight sealing, has few moving parts, short stroke.
Feature: Valve will operate up to 750 cycles per minute intermittent duty and up to 500 cycles per minute continuous duty with air or gas as the medium. Will also operate on oil or water.
Sizes: Available in ⅜, ½, ¾ and 1 inch pipe connection, each capable of being converted from 4-way to 5-way.

Automatic Switch Company
Orange, New Jersey
Circle 222 on Reader Service Card

QUICK CONNECTING COUPLING

. . . for air equipment

Design: The couplings are constructed with identical type valves in each end. These are spring-seated to prevent passage of air when disconnected. Pressurized air bears against the valve ends, sealing them positively. When the couplings are connected, the valves butt against one another and depress. This opens the seats and permits a free flow of air through the coupling. Underwater tests at 125 psi reportedly show no leakage in either half of the coupling, or in the assembly.

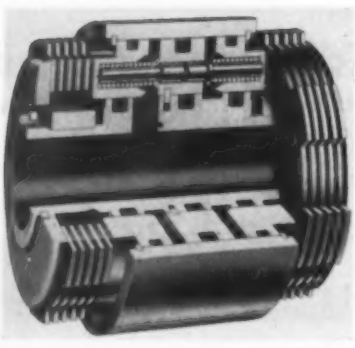
Twinmatic Corporation
West Los Angeles, California
Circle 223 on Reader Service Card

GEAR PUMP

. . . for low pressure uses

Designation: LB Series
Sizes: Available with three capacities—2.5, 3.5 and 4.5 gpm at 1800 rpm and 100 psi.
Features: The design of the LB pump permits use in pumping most liquids having a substantial oil base. The LB series consists generally of two types of pumps, type LBP and type LBS. Model LBP is designed for face mounting or wet sump application. Model LBS includes a shaft seal and is recommended for direct gear or belt drives, and is also available as a 115/230 volt motor pump combination.

Webster Electric Company
Racine, Wisconsin
Circle 224 on Reader Service Card



MULTIPLE PLATE CLUTCH

. . . is oil actuated

Designation: Model MOS (single) and MOD (duplex)
Design: Incorporates an integral oil cylinder to clamp the plate stack. Extensive use of snap rings is employed to provide easy disassembly. The torque capacity of the clutch for any given oil pressure is always constant.
Feature: No adjustment is required to compensate for friction plate wear, since the floating or pressure plate is the ram of the cylinder. As the plate stack wears the ram travel increases automatically. This clutch design needs only a selector valve and a seal.

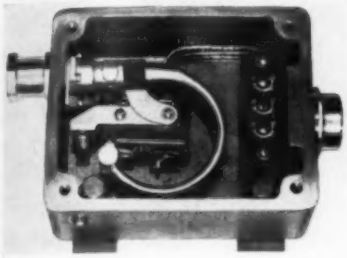
Twin Disc Clutch Company
Racine, Wisconsin
Circle 225 on Reader Service Card

PRESSURE SWITCH
...has variable actuation value

Designation: Meletron Model 314

Specifications: Comes in six classes of proof pressures, to 500, 1500, 3000, 4500, 6000 and 12,000 psi.

Features: Provide accurate sensing of system pressures over an adjustable range of 15 psi to 10,000 psi. Available with ex-



ternal adjustment if setting requires frequent changes.

Operation: The switch will actuate at any predetermined pressure over the adjustable range. The variable actuation value ranges from 10 to 2000 psi, depending on the switch class. Actuation may be on increasing or decreasing pressure, automatically reset by snap action of switch.

Applications: Suitable for liquid, gas or water systems.

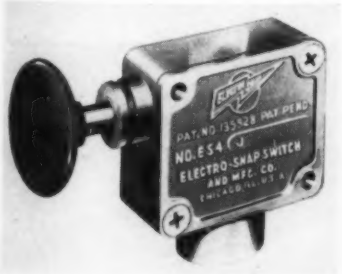
Barksdale Valves
Los Angeles, California

Circle 226 on Reader Service Card

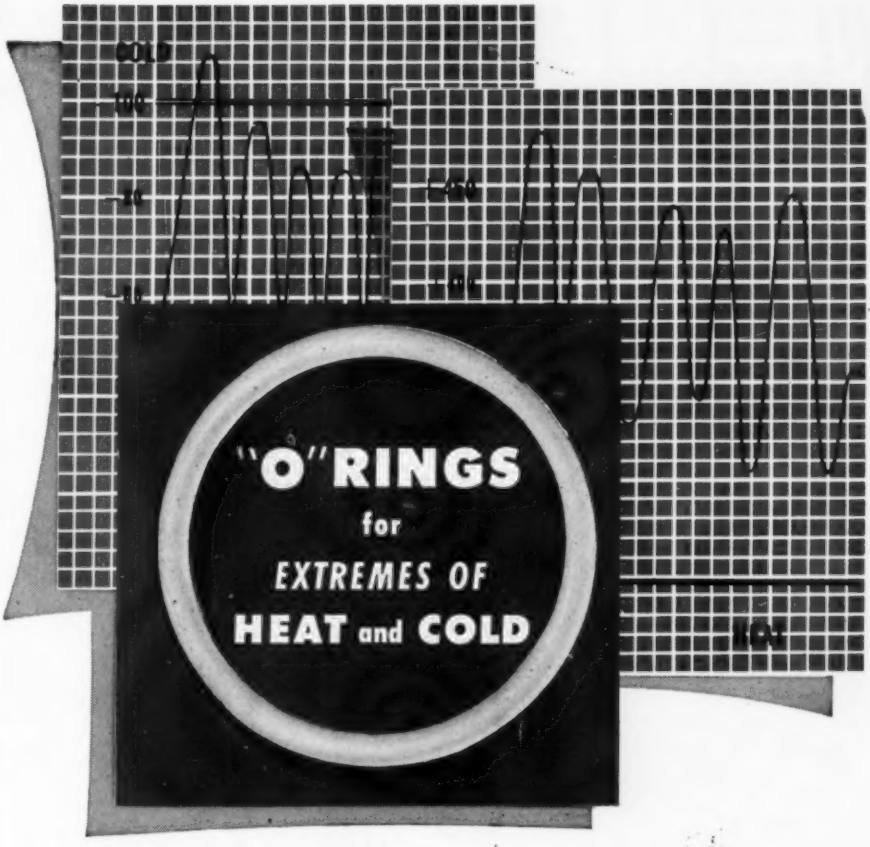
LIMIT SWITCH
...has high electrical rating

Designation: Type ES4-J

Design: Has a die-cast case and integral plunger-type actuator.



A 1¾ inch diameter phenolic plastic button attached to the end of the actuator makes the switch easy to operate manually for stop and start control of mo-



SILICONE "O" RINGS PERFORM OVER A W—I—D—E TEMPERATURE RANGE!

Avoid premature seal failures by selecting the proper "O" Ring materials. For "O" Ring applications that encounter temperature extremes as low as −110°F or as high as +480°F, the use of silicone "O" Rings is indicated. Silicone "O" Rings also provide excellent resistance to chemicals . . . weathering . . . oxidation and moisture. If you have an application requiring "O" Rings to maintain a seal for long periods at either very low or high temperatures, it will pay you to investigate the many properties of silicone rubber. All dash numbers of 6227, 6230 and 6290 series for industrial applications or Army-Navy installations to Specifications MIL-P-5516 (6227 and 6230) and MIL-G-5510 (6290) are available from stock. Silastics and other special compounds are available on order.

Catalog and engineering data on request. Write us today.

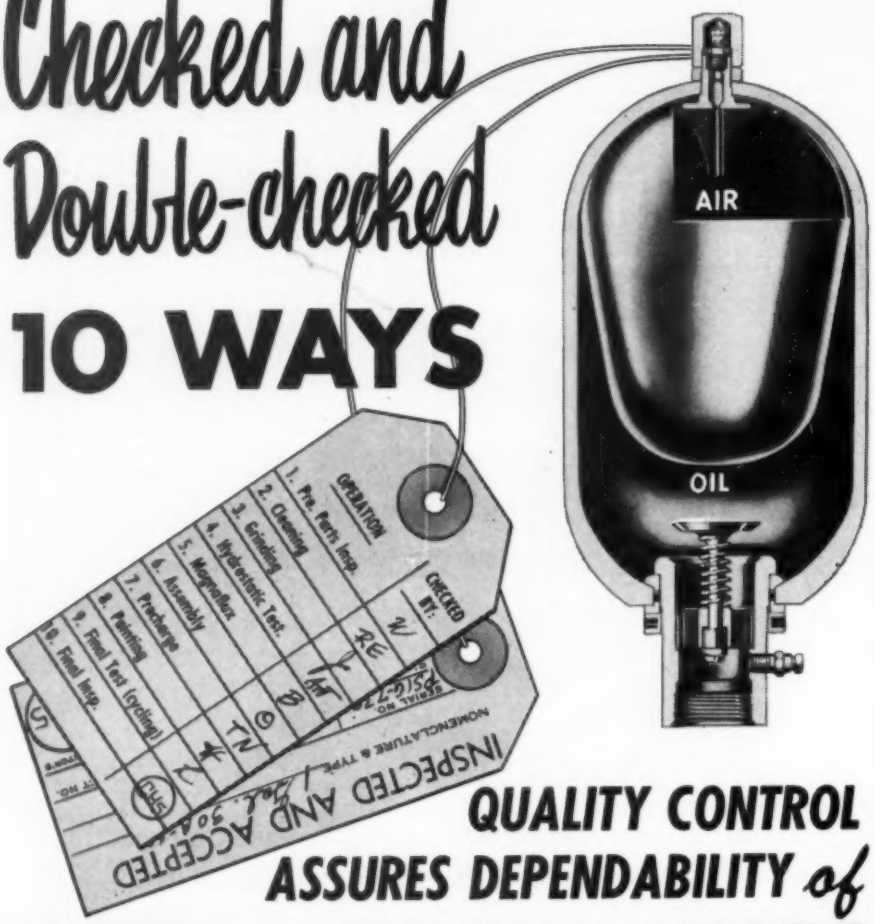
Parco

PLASTIC AND RUBBER PRODUCTS CO.

2100 Hyde Park Boulevard, Los Angeles 47, California
820 North State Street, Chicago, Illinois

Circle 97 on Reader Service Card

Checked and Double-checked 10 WAYS



QUALITY CONTROL ASSURES DEPENDABILITY of GREER ACCUMULATORS

Functions Performed by **GREER ACCUMULATORS**

1. PRESSURE STORAGE CHAMBER to provide
   a. Main source of hydraulic power
   b. Auxiliary power source.
   c. Emergency power source.
2. PRESSURE-VOLUME COMPENSATOR for
   a. Leakage compensation.
   b. Temperature compensation.
3. DISPENSER OF FLUIDS and Lubricants.
4. TRANSFER BARRIER for Fluids and Gases.
5. SHOCK ABSORBER to
   a. Absorb line shocks.
   b. Reduce pump pulsations.

Hydraulic components seldom get such an exhaustive workout during manufacture as Greer Accumulators. At every step on the production line the accumulator parts are checked, double-checked, and signed for by an inspector before the next operator will touch them. Finally the accumulator is cycled as a unit under simulated operating conditions. The inspector who puts his final OK on the tag will bet his life that the accumulator will function properly.

If you want to know how Greer Accumulators can reduce the size, cost, and complexity of your equipment, write or phone.

SEND FOR BULLETIN

GREER ACCUMULATORS
U. S. PATENTS UNDER OLEAR LICENSES

Greer Hydraulics, Inc.
456 18th Street,
Brooklyn 15, N. Y.

Sales Representatives in Principal Cities
District Offices: 407 So. Dearborn St., Chicago 5 • 2832 E. Grand Blvd., Detroit 11
Manufactured and distributed under license in Great Britain by Finney Presses Ltd., Berkeley St., Birmingham 1, England.

New Products

tors. Its small size and adaptable mounting means make it possible to locate the switch at the most convenient position for the operator.

Feature: The switch is available with either constant or one-way momentary contact action. Constant contact action completes a circuit as the switch is actuated and breaks the circuit as the actuating force is removed. When actuated the one-way momentary contact model sends an electrical impulse and then opens the circuit for the rest of the plunger's forward movement. The switch is not tripped as the plunger returns to its originally extended position. This type of action eliminates the need for costly relays in automatic sequencing operations and provides an opportunity for unusual control circuits.

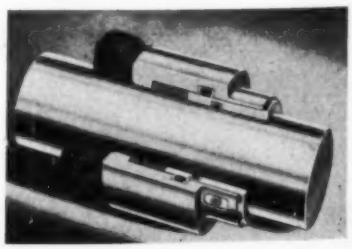
Service: The switch has a high electrical rating, 10 amps at 125 volt AC. Available with a single-pole, double-throw circuit arrangement only. Mounting is extremely versatile and the switch is easily wired into a circuit through a standard industrial conduit connection. Clearance dimensions including knob actuator and conduit connector are 3⅜ x 2⅝ x 1¾ inches.

Electro-Snap Switch and Mfg. Co.
Chicago, Illinois

Circle 227 on Reader Service Card

"O" RING MECHANICAL SEALS
. . . for rotating pump shafts

Designation: Type O and Type OB (illustrated)



Features: To withstand any liquid, whether mild, harmfully corrosive or extremely hazardous, on rotating pump shafts. Are designed to give leakless

operation of rotary shafts on centrifugal pumps handling chemicals, petroleum products and many other liquids. Type O is an unbalanced seal for pressures up to 200 psi and Type OB a balanced seal for pressures up to and over 1000 psi. Both types can be supplied with single spring or multiple spring, and in either pin-drive or sleeve drive construction.

Sizes: Type O seals are furnished for packing space 5/16 inch and larger. In some cases they can be made for ¼ inch packing space. Type OB are furnished for 3/8 inch and larger packing spaces. The seals are available in Teflon, Buna-N, Neoprene or Silicone.

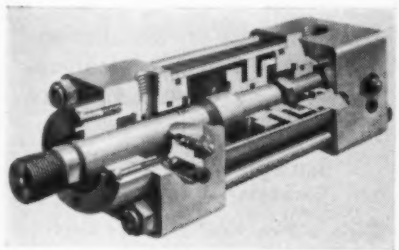
Garlock Packing Company
Palmyra, New York

Circle 228 on Reader Service Card

CYLINDERS
. . . feature floating cushion

Features: Air line cylinders with honed brass, corrosion resistant barrels, designed for unlimited fatigue life at rated loads. Honed steel tubing is used for the barrel of the hydraulic cylinders. Piston seals are leather caps impregnated with synthetic rubber and are inherently leakproof.

Application: Two lines of cylinders are offered for air service



up to 200 psi and low pressure oil service to 500 psi.

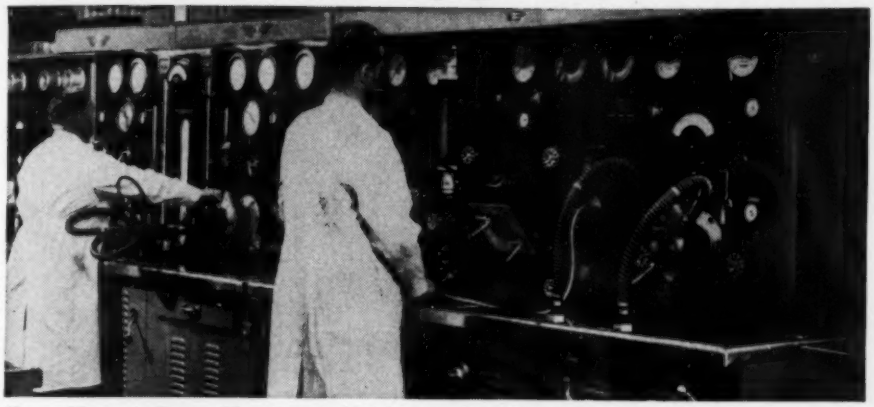
Sizes: Air cylinder offers 14 models and bore sizes ranging from 1½ to 6 inches at 200 psi, 14 models and bore sizes ranging 7, 8 and 10 inches at 150 psi and hydraulic cylinders 14 models and bore sizes from 1½ to 5 inches at 500 psi.

Petch Manufacturing Co.
Detroit, Michigan

Circle 229 on Reader Service Card

GREER TOPICS

Important News of Aviation & Industrial Test Equipment



Greer Vacuum Pump Test Stand *(left)* is used by Trans-Canada to test vacuum pumps up to .5 inches of mercury, 80 cubic feet air per minute capacity. Greer Dual Fuel Pump Test Stand *(right)* accurately tests both engine driven and electrically driven pumps.

How Trans-Canada Airlines Tests Two Components at Once

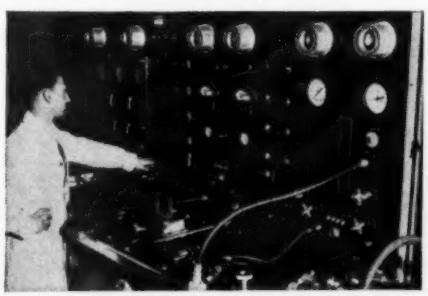
Trans-Canada flies its famous North Star planes on a busy schedule over two continents. The idea is to keep these planes in the air—and this means test and maintenance must keep pace.

The airline asked Greer to adapt its standard test equipment so that one machine could handle two components simultaneously. Photos on this page provide the evidence that this specification was successfully met.

Trans-Canada, like other leading airlines, will vouch for the dependability of Greer equipment. Each machine is slowly and painstakingly produced, carefully tested in each stage of production for highest order accuracy and long service life.

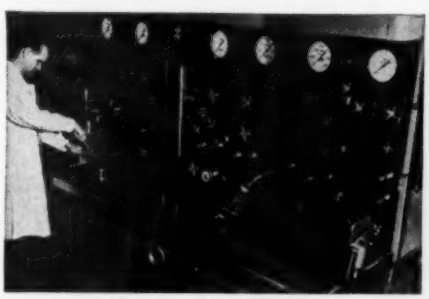
The men who design and build them have many years of very specialized experience in this narrow field. It is experience that is difficult to find, perhaps impossible to match elsewhere.

These men know well that each machine carries their reputation on its nameplate. This is your absolute assurance of complete satisfaction with Greer Test Machines.

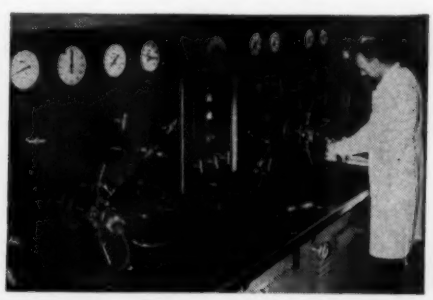


Greer Anti-Icing Pump and Distributor Valve Test Machine, shown in operation at Trans Canada, checks anti-icing pump and performance of de-icer distributor valve.

GREER
TEST EQUIPMENT



Greer Stationary Hydraulic Accessories Test Machine fully checks all hydraulic system accessories including the system pump, includes a 25hp variable speed drive.



Greer Hydraulic Pump Test Machine tests aircraft engine hydraulic pumps rated at 3400 psi and flow rates to 10 gpm. Accepted for use by USAF and foreign countries.

Greer Hydraulics Inc. 454 Eighteenth Street, Brooklyn 15, New York

Field Offices: 1908 West Cermak Road, Chicago, Illinois • 25 South Main Street, Dayton, Ohio
2832 East Grand Boulevard, Detroit, Michigan • and sales representatives in all principal cities

Circle 43 on Reader Service Card

Would you rather drive

this...

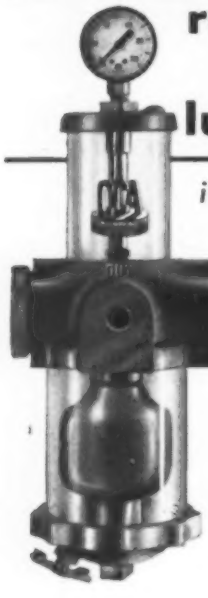
or this...

FOR YOUR PLANT
INSIST UPON THE

CCA

FOR COMPRESSED AIR

regulator
filter
lubricator



it's years ahead of the field!

Compare CCA's Regulator-Filter-Lubricator with any on the market. You'll find CCA's advanced design nothing short of astonishing! It's more compact—all in one unit—saves space. Installation involves just 2 pipe connections. (Remember—added connections mean added chance of leaks, added expense). It supplies metered lubrication automatically. Filter removes liquid water by centrifugal action. Unit provides piston type regulation —down to ¼ lb. WITH PRESSURE RELIEF FEATURE BUILT IN. CCA is your best buy . . . by far. Stocked in principal cities. Catalog on request.

CCA PRODUCTS DIVISION

BRECO MANUFACTURING CO.
309 E. SARATOGA ST. • BALTIMORE 2, MD.
Complete line of compressed air line equipment-including Filters, Lubricators, Regulators, DeHumidifiers

New Products

Continued

HYDRAULIC IRON CUTTER
. . . for structural members

Designation: Model A-20-B
Sizes: 3 x 3 x ¼ inch or 2 ½ x 2 1/2 x 5/16 inches.
Service: Cuts with a straight,

clean shear and causes no deformation of the angle iron end. Cutters do not have to be bolted down or otherwise mounted for operation. The unit is available in portable models.
Application: Cutting of angle iron and for production cutting.

Manco Mfg. Company
Bradley, Illinois

Circle 230 on Reader Service Card

WRITE-ON LABELS
. . . for pipe identification

Features: Mounted on handy dispenser cards with exclusive starter-strip that provides fast convenient removal of labels. Available in a choice of colors,

including red, green, yellow, blue, orange and others.
Specifications: Stock labels are pre-cut to exact size ⅝ x 1½ inches. They come mounted on a card, 14 identical labels to one card. Special labels are made to order.
Application: For solving industrial identification problems and use throughout the plant, marking of dies, specimen and tools as well as individual parts and to identify equipment and machinery for overhaul or repair.

W. H. Brady Company
Milwaukee, Wisconsin

Circle 231 on Reader Service Card

PIPE LINE AIR FILTERS
. . . feature one-bolt accessibility

Designation: Model AA Series
Features: Can be inspected and cleaned without removing filters from the line. Available in any or a combination of four models. They are manufactured

in two sizes and each size can use either absorption pad media or the original Dollinger radial fin inserts.
Applications: For installations requiring only 40 psi maximum pressures for compressed air or gas.

Dollinger Corporation
Rochester, New York

Circle 232 on Reader Service Card

VIBRATION ISOLATOR
. . . protects instruments

Designation: Cohrlastic DS Non-Linear Mount
Design: This mounting has a decreasing slope of its load-deflection curve. This means that the mount absorbs small vibrations with little deflection or movement of the equipment. At low loadings it is relatively stiff. At high loadings, such as a heavy shock, when a piece of

Circle 21 on Reader Service Card →

When correct design and dependable performance are especially important

you can depend on Chicago Rawhide for reliable solutions to your mechanical sealing and protection problems

SIRVENE

SCIENTIFICALLY COMPOUNDED ELASTOMERS

(Synthetic Rubber)

When you need an oil-resistant, pliable part with an exact degree of flexibility, hardness, resistance to extreme temperatures, fluids, gases, abrasion and wear . . . whether it be an intricately designed diaphragm or boot . . . or a simple but critical packing or gasket . . . Sirvene will serve you dependably.

Write for "Engineering with Sirvene"

sirvis

MECHANICAL LEATHER PRODUCTS

Actual tests prove Sirvis packings require less replacement than any other type. Made in a complete line of cup, flange, U and V types from specially treated and tanned steerhide. Available in special designs, scientifically engineered to solve unusual situations.

Write for Sirvis Mechanical Leather Catalog

C/R *Oil Seals*

The "Perfect" answer to fluid retention, moisture and foreign matter exclusion, and similar mechanism protection problems. Used more than any similar device in motor vehicles, industrial machines, farm implements, and road machinery. Stocked in over 1800 sizes, covering 16 different types.

Write for "Engineering with C/R Oil Seals"

1878 75 1953 SEVENTY FIFTH ANNIVERSARY C/R

CHICAGO RAWHIDE MANUFACTURING COMPANY

1301 Elston Avenue, Chicago 22, Illinois

Representatives in these Principal Cities

Boston • New York • Syracuse • Philadelphia • Pittsburgh • Cincinnati • Cleveland Detroit • Peoria • Minneapolis • Kansas City • Houston • Los Angeles • San Francisco

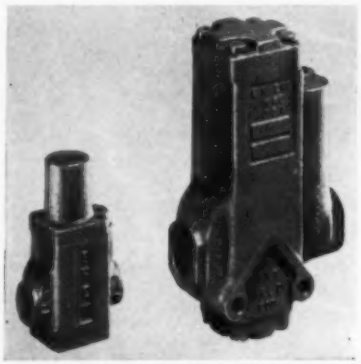
Continued

equipment is dropped, the mount serves as a soft cushion absorbing the energy of impact and returning the equipment unharmed to its original position.
Application: Provides shock and vibration protection for electronic equipment, delicate instruments, aircraft engines and equipment which may suffer damage in shipment. Also used as a shock mounting under heavy machinery.
Sizes: Available in sizes from small ½ lb rated load to large 500-1000 lbs rated loads.

Connecticut Hard Rubber Company
New Haven, Connecticut
Circle 233 on Reader Service Card

FLOW CONTROL
... for lift truck circuits

Design: The automatic self-regulating flow valve controls the lowering speed of a load in inverse proportion to load weight. The heavier the load the slower it descends. Of prime importance, particularly when the load is near the truck's rated



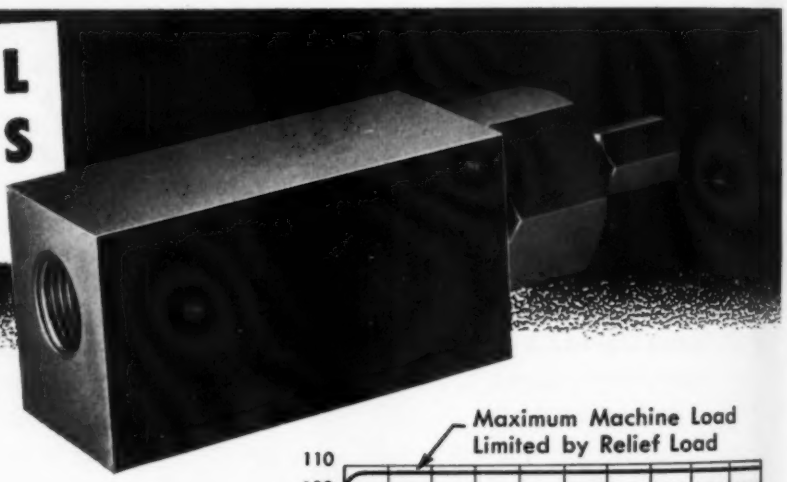
capacity, is the positive elimination of surge at the start of lowering.
Feature: Available in any desired maximum or minimum of travel. The manual control of the truck operator is not affected when raising the load or at lowering speeds slower than the flow control valve setting. No additional controls are required because this valve is installed straight-in-line in the high-pressure line from the manual control to the cylinder. When built into the hoist cylinder base as original equipment, it serves as a safety valve in case of ruptured oil line because the load cannot descend faster than the predetermined speed.
Application: For fork and straddle trucks and lift truck industry.
Sizes: Available for 2000 lb to 30,000 lb fork trucks and 45,000 lb straddle truck.

Benton Harbor Engineering Works
Benton Harbor, Michigan
Circle 234 on Reader Service Card

SPEED CONTROL VALVE
. . . for air circuits

Sizes: Available with ¼, ⅜, ½, ¾, 1 and 1¼ inches IPT.
Design: A feature of the valve is the ease of adjustment, accomplished by the many turns provided on the adjusting stem.

FLUID CONTROL RELIEF VALVES REDUCE COST

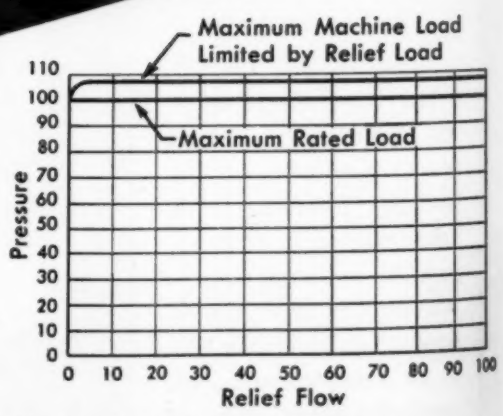


Accurate control of maximum pressure permits savings in cost of all machine parts.

You can limit maximum pressure to 10% over machine rating without loss of efficiency at full rating.

Write for detailed data and specifications.

- For Oil
- ¼" x ⅜" pipe sizes
- Relief Pressure — Adjustable
  50 to 1,000 P.S.I. or
  500 to 4,000 P.S.I.



Fluid Controls, inc.

Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves • Needle Valves • Pilot Check Valves • Clamping Valves • Small Spring Loaded Accumulators • Special Valves

1284 N. CENTER STREET MENTOR, OHIO

Circle 35 on Reader Service Card

custom tube fabrication

bend

bead

flare

braze

jic

an

TUBE FABRICATION

OMI

COMMERCIAL • AIRCRAFT

jic hydrostatic tested seamless tubing

- *field engineering expert in hydraulics will assist in design and layout of pilot models on production units.*
- *facilities available for high production as well as short run custom bending at low cost.*

olivet manufacturing, inc.

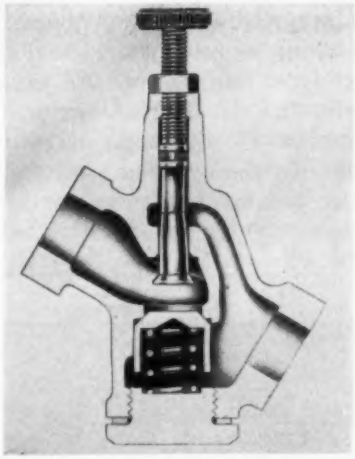
olivet, michigan

representatives:
chicago - cleveland - dayton
dallas - detroit - grand rapids

Circle 78 on Reader Service Card

The orifice controlling this flow can be quickly adjusted from practically zero to wide open.

Application: Can be used wher-



ever it is necessary to control the flow of air. Provides split-second timing of piston movement by positive control of air flow. It can be mounted in any position between the operating valve and one or both ends of a cylinder to provide air flow adjustment.

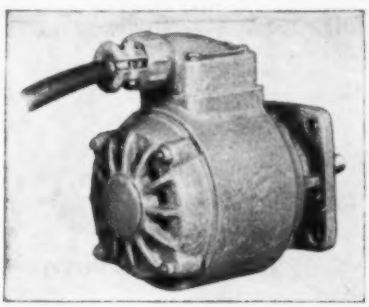
Ross Operating Valve Company
Detroit, Michigan

Circle 235 on Reader Service Card

AIRCRAFT MOTOR

Sizes: Available from 1/20 to 16 hp.

Features: Self ventilation, AN mounting pad, pre-packed ball bearings, thermal overload protection rapid acceleration and

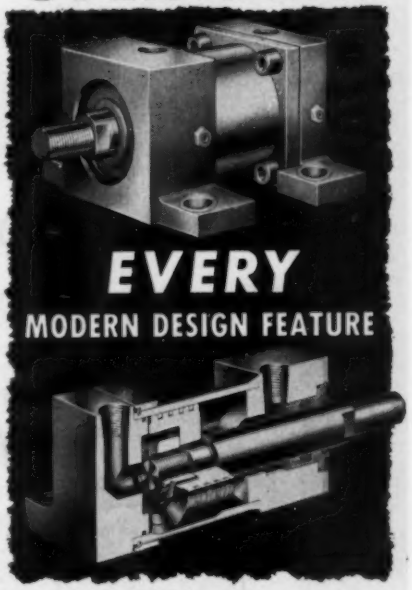


high starting torque. Having a take-off shaft speed of 7300 rpm the 1/20 hp, 400 cycle, 3-phase AC motor designed to operate at an altitude of 50,000 feet is used in pressurization units for high altitude applications.

U.S. Electrical Motors Inc.
Aircraft Div.
Los Angeles, Calif.

Circle 236 on Reader Service Card

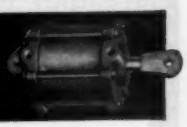
HYDRAULIC CYLINDERS



- 2000 p.s.i.
- Compact design
- J.I.C. Standards
- 11 models in 11 sizes
- Up-to-date engineering
- All steel construction
- Wide choice of rod sizes
- Quick-change packing cartridge

S-P makes hydraulic cylinders for the world's largest corporations. Representatives in principal cities. Prompt deliveries. Send for copy of S-P Catalog No. 103.

S-P AIR CYLINDERS



Famous for long life—low downtime. Piston packings "replace" themselves. Prompt deliveries. Send for Catalog 102.

OTHER S-P PRODUCTS: Power Chucks, Rotating Air Cylinders, Parallel Grip Collet Chucks, Drill Press Chucks, Expanding Arbors, Blank Jaws, Air Valves, Air Pistons, Air Control Accessories.

THE S-P MFG. CORP.
ESTABLISHED 1916
12415 EUCLID AVENUE
CLEVELAND 6, OHIO
A Bassett Company

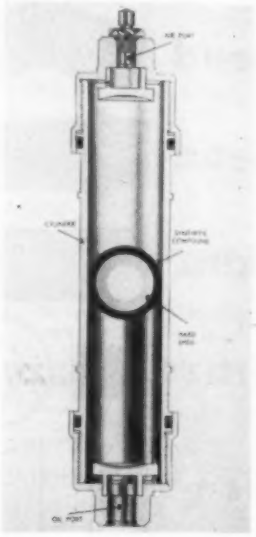
Circle 112 on Reader Service Card

Continued

HYDRAULIC ACCUMULATOR
. . . uses spherical piston

Design: This accumulator employs neither a compressible bag nor a conventional type piston, but rather makes use of a hard-shell ball bonded with the proper thickness and durometer of a synthetic compound to be impervious to whatever fluids are used. Inserted into a cylinder with highly polished walls, this ball acts as a spherical piston furnishing its own perfect seal even at low pressures. As greater pressure is exerted on it, the rubber is displaced outwardly against the cylinder wall so that the greater the pressure, the tighter the seal. Yet the ball is free to roll, squeeze and turn as it slides back and forth in its functional path always presenting new wear surfaces, insuring long life and dependable performance.

Application: For uses in a wide variety of fields as both a prime and emergency source of power,



in hydraulic circuits, for power braking, steering and starting in automotive, aviation and locomotion fields.

Sizes: Available in cylinder diameters from one inch to eight inches and in length to furnish any required capacity.

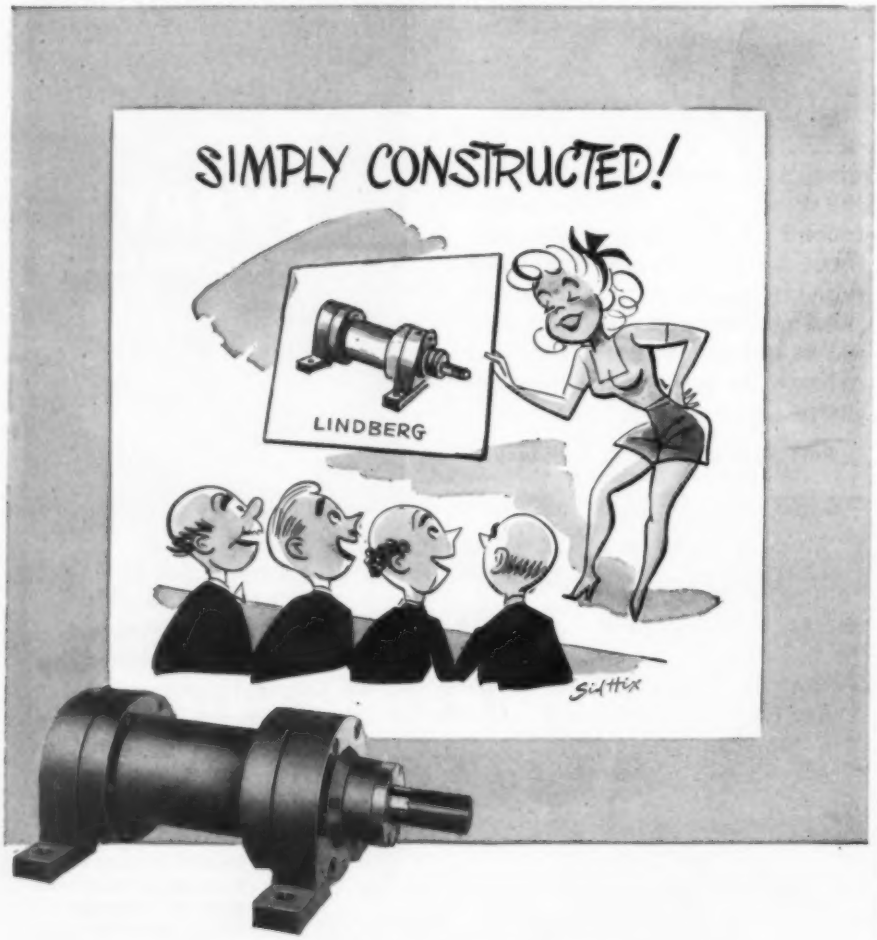
Harris & Stevenson
East Greenwich, Rhode Island

Circle 237 on Reader Service Card

HOSE KIT
. . . speeds maintenance

Designation: M-100 Cabinet

Design: Cabinet measures 29 inches wide, 29 inches deep, and 33 inches high. It has six bins containing 50 feet each of H-69 medium high pressure hose of



Specify Lindberg Air or Hydraulic Cylinders for dependable, low cost power for lifting, forcing, pulling, pressing, pushing and clamping. Lindberg Cylinders feature rotatable heads, self-adjusting piston rod packing, and socket head cap screws.

Ask for bulletin No. 701, "Lindberg Hydraulic Cylinders" .. or No. 731, "Lindberg Air Cylinders."

AIR..HYDRAULIC
LINDBERG CYLINDERS

Lindberg Engineering Company,
2441 West Hubbard Street, Chicago 12, Illinois

varying diameters and 28 compartments holding a stock of 86 steel couplings and adapters. To assemble a needed line, it is only necessary to cut the hose to desired length and attach the ends with common bench tools. To complete an assembly requires only a matter of minutes.

Construction: Is made of sturdy steel and has a durable, black crinkle finish. Available with legs and casters if desired.

Application: To stock heavy duty hydraulic hose and reusable couplings for on-the-spot replacement of compressed air, hydraulic, fuel, and lubrication lines on oil drilling rigs and oil field machinery.

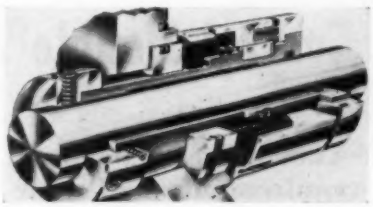
The Weatherhead Company
Cleveland, Ohio

Circle 238 on Reader Service Card

MECHANICAL SEAL
... withstands pressures up to 1000 psi

Designation: Type 8-B

Design: A packaged unit, it incorporates a rotating sealing washer and a floating stationary seat, balance is accomplished by lowering the washer face to a point where stuffing box pressure is not exerted against the sealing area. To insure peak efficiency, mating faces of the washer and seat are precision lapped to .0000232 inches. The rotating assembly consists of a retainer positively driven by the sleeve, with the washer driven from dents in the retainer. The assembly is held in contact with the lapped face of the seat by



means of multiple springs equally spaced around the sleeve at the back of the retainer.

Applications: To be used where ruggedness to withstand high pressure is an important factor.

Crane Packing Company
Chicago, Illinois

Circle 239 on Reader Service Card

TUBE FITTINGS
... require no flaring of tubes

Designation: Sealastic

Design: Connector nipple, synthetic-rubber seal fixed to tube by a metal ferrule and compression nut. Sufficient tube clearance is provided in connection and nut to insure against metal contatc between tube and fitting.

Application: Providing fittings for metal tubing on fuel, hydraulic, air, oil, water and injection lines, finger-tightened fittings withstand pressures up to 4000 psi; when wrench tightened, will sustain pressure resistance beyond that of the tube. Handle temperatures from –70 degrees F to 400 degrees F. Exact alignment of tubes not necessary for coupling.

Sizes: Seal rings, ferrules, nuts, male connectors, female connectors, unions, 90 degree elbows, 45 degree elbows, tees and crosses for ⅛ to 1½ inches oD tubes.

Chicago Forging & Mfg. Co.
Chicago, Illinois

Circle 240 on Reader Service Card

NEW MARSH
Serviceman Soundscope
... cuts servicing and maintenance costs

Most effective instrument ever developed for pin-pointing and identifying mechanical defects. Saves time and dollars tracking down troubles in bearings, gears, mechanisms . . . detects leaks, knocks, piston slaps—any defects that make a sound. A precision instrument of Marsh quality, sensitive to faintest sounds . . . with handy probe and headband as illustrated. A remarkable tool, moderately priced.

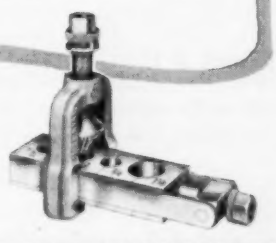
MARSH INSTRUMENT CO.
Sales affiliate of Jos. P. Marsh Corporation
Dept. 19, Skokie, Illinois

Ask for Circular

Circle 65 on Reader Service Card

IMPERIAL 37° FLARING TOOLS
... for making better flares faster!

For flaring soft steel tubing to JIC standards. Also for copper, aluminum and fully annealed stainless steel tubing.

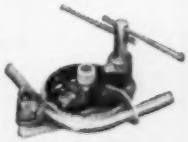


No. 437-F 37° FLARING TOOL. One compact tool flares 6 sizes of tubing—3/16", 1/4", 5/16", 3/8", 1/2", and 5/8" O.D. tubing. Has easy, single lever clamping. Smooth heat treated sliding dies clamp tubing without scoring it.

No. 537-F 37° FLARING TOOL FOR 4 LARGER SIZES. Has rollers in flaring cone which make flaring of larger sizes easier. Automatically burnishes flares assuring tighter joints. For 3/4", 7/8", 1", 1-1/4", O.D. tubing.

Ask for Bulletin 3011

Also a complete line of tube cutters, 45° flaring tools, tube benders, reamers, etc. **No. 274-F** Tube Cutter and **No. 270-F** Gear Bender are illustrated.



See Your Supply House

THE IMPERIAL BRASS MFG. CO., 1242 W. Harrison St., Chicago 7, Ill.
In Canada: 334 Lauder Ave., Toronto, Ont.

IMPERIAL — PIONEERS IN TUBE FITTING AND TUBE WORKING TOOLS

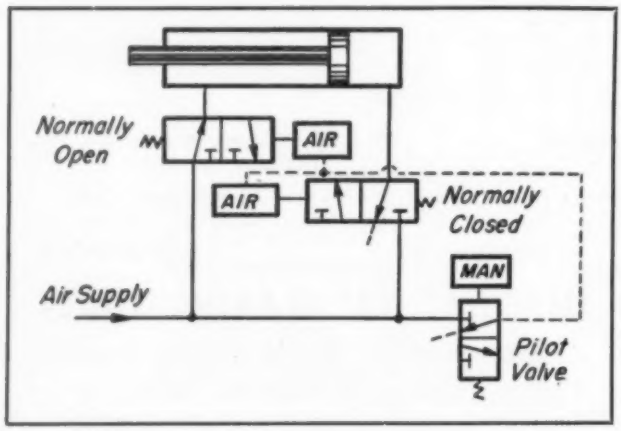
Circle 52 on Reader Service Card

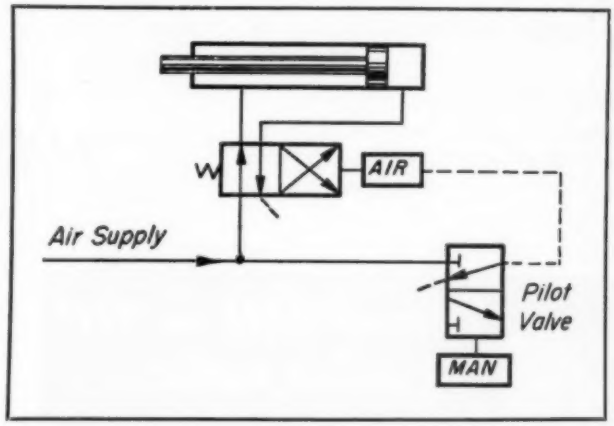
Data Sheet

For Your Pneumatic and Hydraulic Design Notebook

Simple Air Circuits Control Double Acting Cylinders

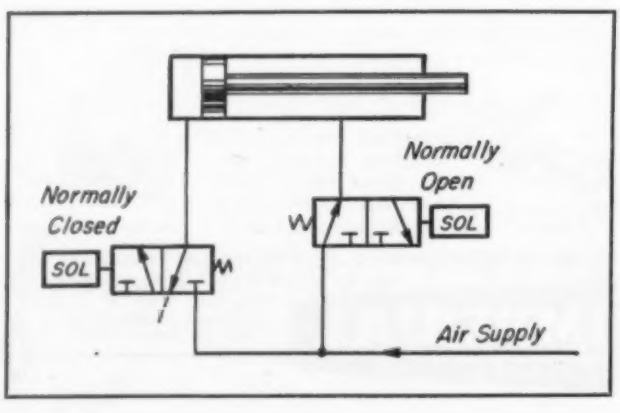
Which air circuit is best? Your choice depends on available equipment, machine layout, cycling requirements and your ingenuity in circuit layout. Here are nine typical air circuits to power cylinder pistons.

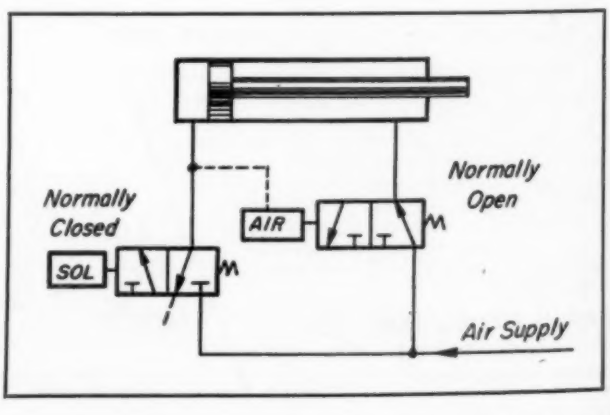




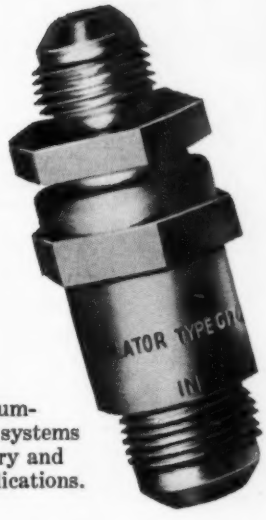
1 and 2 Pilot operated valves control cylinder reciprocation in circuit 1. The pilot valve may be manually operated as shown or electrically operated. Mounting the 3-way pilot operated valves close to the cylinder, speeds air supply and exhaust. This circuit does not permit stopping the piston at any point in the stroke. In circuit 2, a pilot operated 4-way valve serves the same purpose as the two 3-way valves in circuit 1.

3 and 4 To produce forward motion, both valve solenoids in circuit 3 are energized. Deenergizing the solenoid to the position shown retracts the piston. Circuit 4 does the same job using one solenoid operated 3-way valve and a pilot operated 3-way valve. The circuit is shown deenergized, the piston retracted.





for high-pressure systems.



for medium-pressure systems in military and tool applications.

replaceable element type, for hydraulic tool applications.

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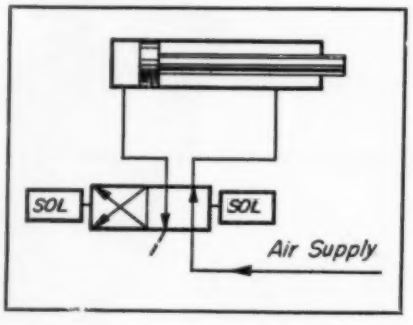
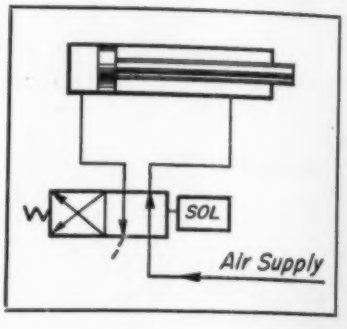
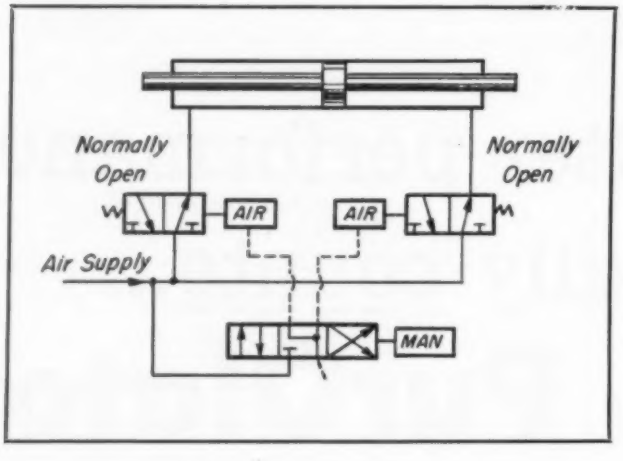
Simple Air Circuits

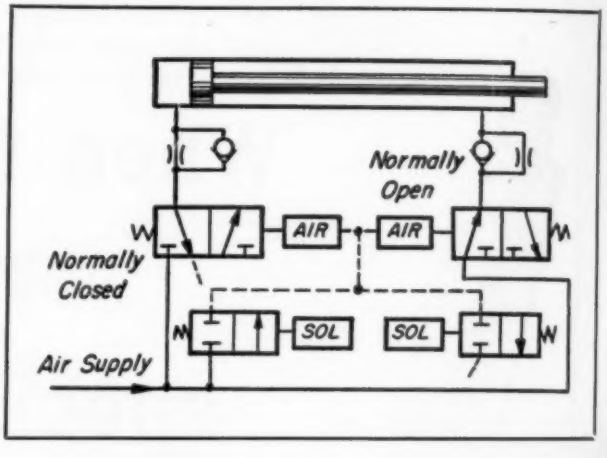
Continued

5 and 6 Four-way solenoid valves are used in electrically operated circuits. Solenoids on the double solenoid valve need only be energized momentarily, making relays unnecessary. With the single solenoid spring offset valve, the solenoid must be held energized during the forward stroke. Deenergizing the soleoid results in reversal of stroke.





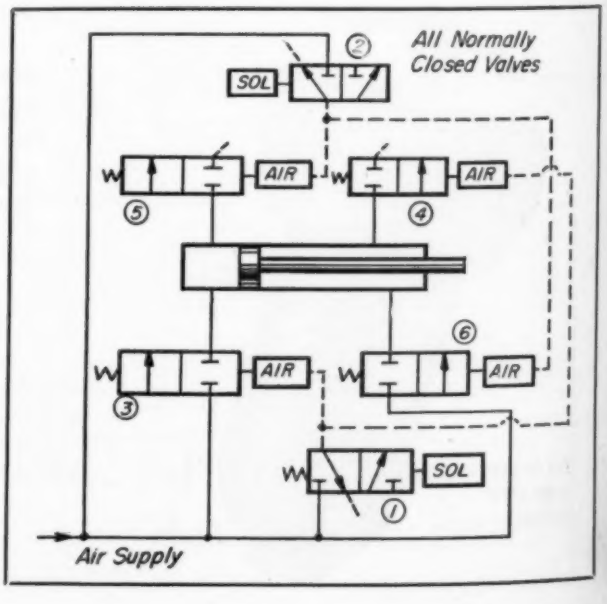




7 With this circuit, inching of the piston is possible. Air pressure acts on both sides of the piston head, when the manual 4-way, three position valve is in the neutral position. Shifting the 4-way valve to either working position will open one side of the cylinder to exhaust through a 3-way valve and keep air pressure on the other side. Piston rod travel can be stopped at any point in its stroke by putting the 4-way valve in neutral.

8 Momentarily energized solenoid operated pilot valves are used in this reciprocating circuit. Energizing valve 1, will open the head end to pressure and the rod end to exhaust. This causes the piston to move forward. To reverse the stroke, valve 2 is momentarily energized releasing pilot pressure and putting both 3-way valves in their normal positions are shown. Speed control valves can be put in all circuits as shown here.

9 Air pressure is trapped on both sides of the piston to stop piston travel at any point in its stroke. Energizing solenoid valve 1 directs pilot pressure to valves 3 and 4 to permit forward motion. At any time during the stroke, valve 1 can be deenergized to release pilot pressure and close valves 3 and 4. With valves 3 and 4 closed, trapped air on both sides of the piston stops piston travel. Valve 2 controls the piston return stroke.



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Standard sizes range from 1/16" to 1½".

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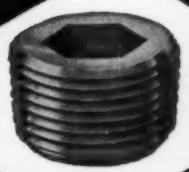
ALLEN Tru-Round PIPE PLUGS



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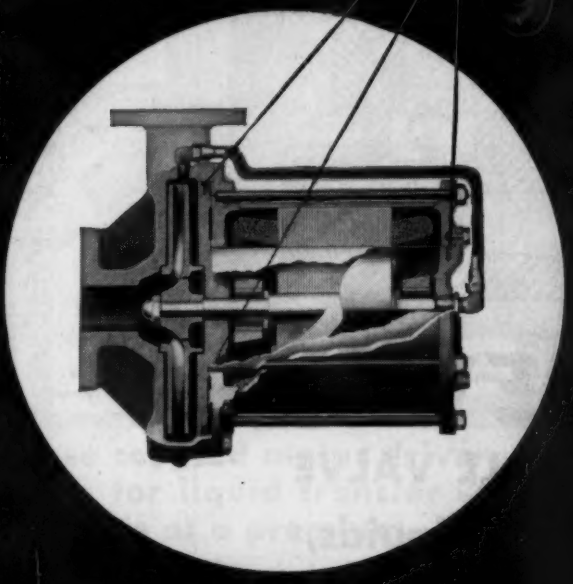
All Prices F.O.B. Los Angeles

LINEAR O-RINGS

simplify design . . .



. . . speed assembly of "packingless" pump

Through ingenious use of Linear O-rings, the unique "Chempump" ends all sealing problems. Designed for corrosive liquids, this pump allows pumped fluid to circulate through the rotor chamber... eliminates stuffing boxes and their leakage, adjustment and friction troubles.

Linear O-rings provide the ideal way to put this design idea to work. A pair of them seal off the stainless steel cylinder that surrounds the rotor, and another seals the impeller housing in place. They prevent fluid from leaking into the stator windings, by means of a seal that never needs adjustment... takes extremely little space... is quick to assemble and disassemble... and is far simpler and safer than other packings.

Precision-moulded Linear O-rings are supplied in neoprene, Buna-N, Kel-F and many other natural and synthetic elastomers. Write or call Linear for full information.

"PERFECTLY ENGINEERED PACKINGS"

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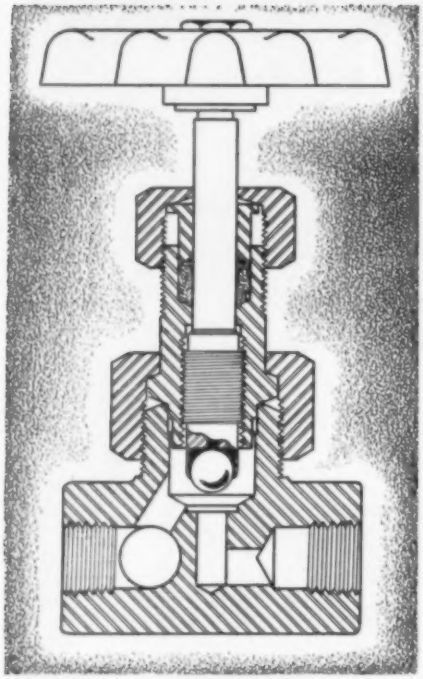
Circle 60 on Reader Service Card



NEW!

BALL VALVE

for liquids, gas or steam

Here's a radically-new forged steel valve for general heavy industrial use. Can't leak . . . practically never wears out . . . costs little or no more than ordinary valves!

In place of a disc or plug, the new Foxboro Ball Valve has a retained, free-rolling stainless steel ball that exposes new surface to seat at every closing.

Foxboro Ball Valves handle pressures to 3000 psi. Available in straight-thru and angle types. Two or four connections to simplify piping. ¼" size. Write for detailed folder.

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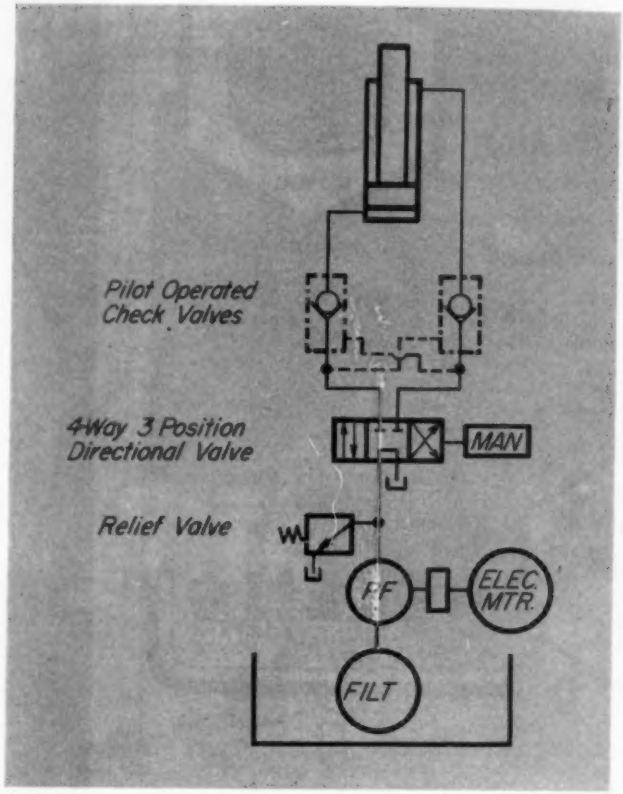
INSTRUMENTATION

How to Use Pilot Check Valves for Positive Locking



PILOT OPERATED CHECK valves are used to insure complete locking of hydraulic cylinder when the 4-way valve is in neutral.

BECAUSE there is always some leakage through a closed center 4-way directional spool type valve, it is impractical to depend on the 4-way valve alone to lock a hydraulic cylinder. Prevention of creep is particularly important on clamping devices and on lift truck rams. On these machines it is important that when the operator moves the valve handle to "hold" position that the load will not release.

One solution to this holding problem is shown in the circuit sketch. This circuit uses a conventional spool type, cylinder ports blocked in center, manually operated 4-way valve to raise and lower the cylinder. With the valve in neutral, oil is trapped in the cylinder and if it were not for leakage the ram would be locked. Positive locking to be accomplished by the use of the pilot operated check valves located in the rod end and head end lines between the cylinder and directional valve. These valves being of poppet type construction seal tight—the seal becomes tighter as oil pressure above the poppet increases. In the "raise" and "lower" operating positions, one check will permit flow to the cylinder through its normal free flow position; the other check valve will be held open by pilot pressure to permit return flow from the cylinder.

On some large installations, this requirement for positive hold has resulted in the use of mechanical brakes to lock the ram. This is often impractical because of cost, space and complexity of operation. Some manufacturers have developed poppet and plug valves to be used in place of a spool valve for directional control. These valves have practically zero leakage in the hold position.

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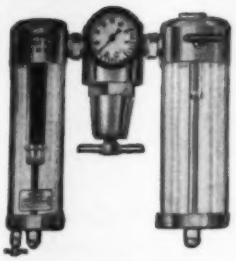
Prominent User Acclaims

"M-B" Automatic Air Line FILTER, REGULATOR and LUBRICATOR Assembly



The value of "M-B" Automatic Air Line Filters, Regulators and Lubricators is widely known for their effectiveness as a protection to Air Valves, Cylinders, Pneumatic Tools, etc.

"Your 'Sentinel of the Air Line' has been giving us very good service. We have had no complaints at all and I trust that we will be ordering more of them in the near future."

signed: **A. E. Cranston, Sr.**
PRESIDENT

Cranston Steel Strapping Co.
Oak Grove, Oregon

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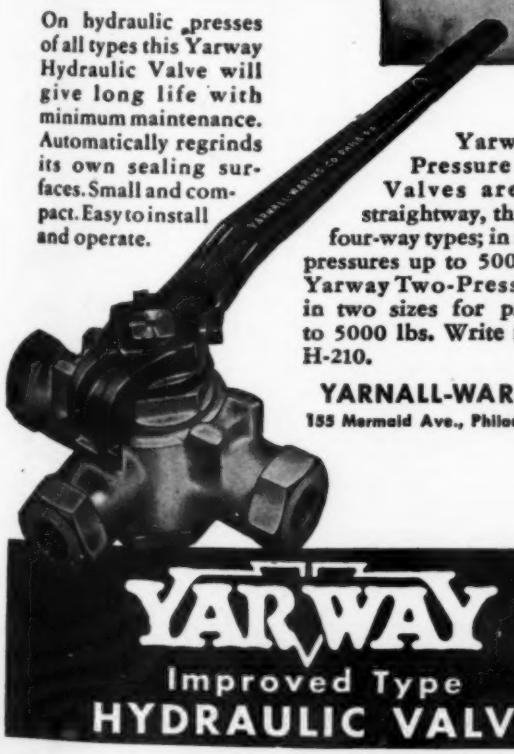
The Higher the Pressure ...the Tighter the Valve

On hydraulic presses of all types this Yarway Hydraulic Valve will give long life with minimum maintenance. Automatically regrinds its own sealing surfaces. Small and compact. Easy to install and operate.



Yarway Single-Pressure Hydraulic Valves are made in straightway, three-way and four-way types; in five sizes for pressures up to 5000 lbs. Also Yarway Two-Pressure Valves in two sizes for pressures up to 5000 lbs. Write for Bulletin H-210.

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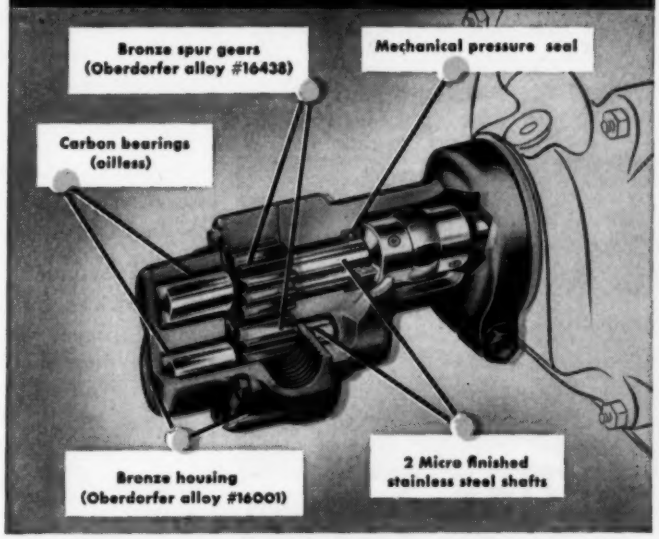
YARWAY
Improved Type
HYDRAULIC VALVE

INTERNATIONAL Series II OBERDORFER BRONZE ROTARY GEAR PUMPS


Bronze spur gears (Oberdorfer alloy #16438)
Mechanical pressure seal
Carbon bearings (oilless)
Bronze housing (Oberdorfer alloy #16001)
2 Micro finished stainless steel shafts

Close coupled motor driven units for liquid transfer where space is at a premium.

International Series II Pumps have all-bronze housings and gears, oilless carbon bearings, micro-finished stainless steel shafts (± 25/100,000 of an inch) and are powered by heavy-duty ⅓ h.p. motors* equipped with thermal overload protection.

They are intended to be used wherever a liquid has to be moved from one location to another in quantities up to 240 gallons per hour at pressures from 0 to 100 lbs. per square inch.

International Series II Pumps are adaptable for a wide variety of industrial and chemical applications where a corrosion-resistant pump is required and space is limited. Their all-bronze body and gears permit use with most liquids.

***Standard 110 v. AC Motor, specially machined for pump mounting**

Capacity Tables Gals. per min. — 1,725 R.P.M. — lbs. sq. in.

Pressure	Pump No. 1½ CCC	Pump No. 2 CCC
0 lbs.	2.10 gal.	4.10 gal.
25 lbs.	1.83 gal.	3.67 gal.
50 lbs.	1.67 gal.	3.17 gal.
75 lbs.	1.58 gal.	2.83 gal.
100 lbs.	1.50 gal.	—

Dimensions (Pump Only)

Pump No.	Pipe Size	Height	Width	Length
No. 1½CCC	⅜"	2⅞"	2 11/16"	4¾"
No. 2CCC	⅜"	3 11/16"	2⅞"	4⅞"

Pump No. 1½ CCC — Pump head only.....$20.00
Pump No. 2 CCC — Pump head only.....$22.50

Complete units with 1/3 hp. 110 volt AC Thermal overload motors (motor standard, but specially machined for pump mounting). Motor price $13.50 net.

Industrial Pump Div., Oberdorfer Foundries, Inc.
536 Thompson Rd., Syracuse, N. Y.

See our catalog in Sweet's PRODUCT DESIGN File

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DOUGLAS

KOBE Heavy Duty High Pressure

Triplex Pumps

Case History A-11: July 1947, a Kobe Size 3 Triplex was installed in the engineering test laboratory of the El Segundo Division, Douglas Aircraft Company, Inc. The pump is used primarily for impulse testing, wherein the articles tested are subjected to a 4500 p.s.i. pressure peak at a rate of 90 cycles per minute.

"... Most Severe Destruction Test"
Rate of pressure rise is approximately 200,000 pounds per square inch, per second. P. G. Smith, Manager of the Douglas Engineering Laboratories, states "This is probably the most severe destruction test used to qualify hydraulic components. The Kobe Triplex in its years of service has been subjected to millions of these impulse surges. There has been very little maintenance cost during the the period of operation".

Triplex Features

- Pressures—To 5,000 psi (standard) To 20,000 psi (special)
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- Integral Double Reduction Gears
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Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.

Air Circuit For Automatic Damper Control

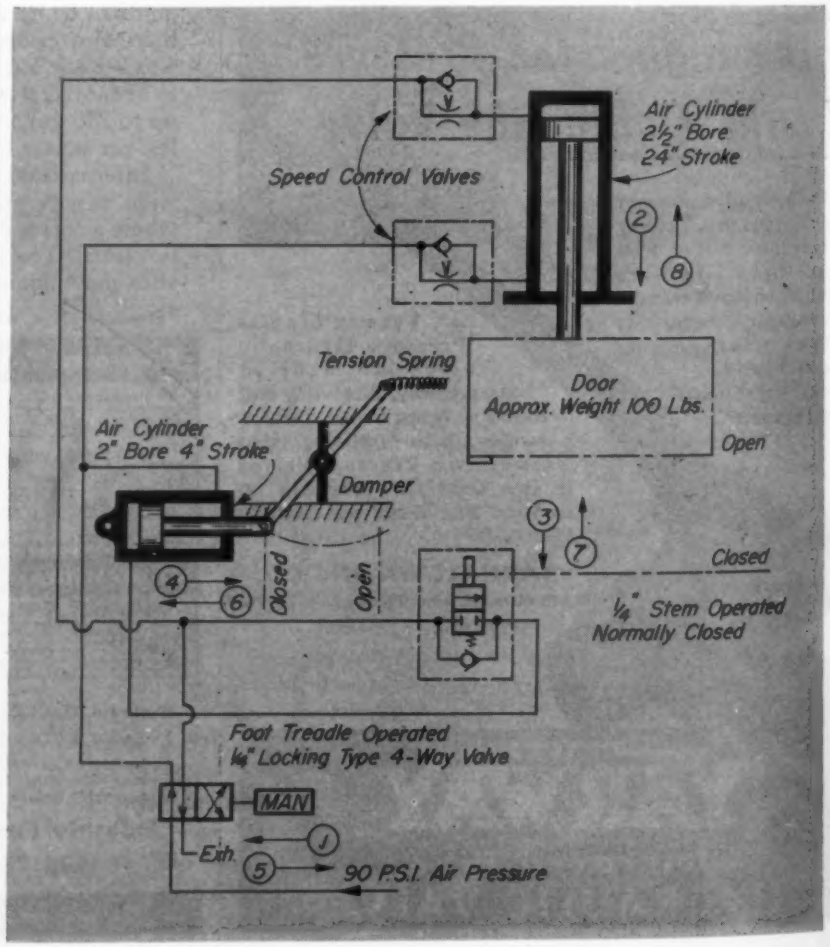
By J. H. McCormick
J. H. Grimstad Co.
Milwaukee, Wis.

AIR cylinders are very efficient devices for opening and closing furnace doors and dampers. Heavy door loads are moved with little effort and timing between damper and door operation is quite simple. The circuit shown here is being used on a furnace for drying molds.

It was the user's desire to have a vertical door closed downward and then the damper opening to add hot, dry air to the oven. They also wanted to be sure that the damper was closed before the oven door opened.

These requirements are easily met with the actuation of a single treadle operated 4-way valve which directs air to close the door. At the bottom of the closing stroke, a cam on the furnace door opens a two way valve permitting air pressure to open the damper. Reversal of the 4-way valve will direct air to close the damper before the door opens.

AIR CIRCUIT for furnace door and damper operation.



What a Good Hydraulic Oil Should Have

ONE of E. F. Houghton & Co's recent service bulletins details the seven "desire-abilities" which hydraulic oils should have. These seven factors:

1. Pumpability
2. Lubricating ability
3. Chemical stability
4. Rust inhibiting ability
5. Demulsibility
6. Non-foaming ability
7. Compatibility

are important to check before buying hydraulic oil.

Here's what each "desire-ability" means to the hydraulic oil user.

Pumpability

The oil must flow through the hydraulic system with little or no fluctuation over a wide temperature range. Pumpability is determined by the viscosity and the "viscosity index" of the liquid. Of the two, viscosity is the more important because this controls the internal friction of a substance or its resistance to flow. Second in importance is the viscosity index, which is an indicator of the rate at which an oil will thicken or thin with temperature changes.

The oil supplier, by using only highly refined oils and fortifying them with special additive treatment, can meet the various viscosity and viscosity index requirements.

Many users confuse the oil's ability to flow at low temperatures with its pour point. Because the pour point is the lowest temperature at which the oil will flow or can be poured without agitation, it is much wiser to judge the usefulness of a hydraulic oil from the standpoint of its pumpability at low temperatures. Pumpability is related only indirectly to its pour point.

To cite an example, consider two oils with similar pour points. The first may get too viscous to be pumped at a temperature considerably higher than its pour point. The second oil, on the other hand, might still be quite fluid and easily pumped at temperature just a few degrees above its pour point. The second oil, therefore, would be a wiser selection because of its better pumpability characteristics.

Lubricating Ability

Because of the rigid requirements and close tolerances that manufacturers adhere to in designing and building hydraulic machinery, particularly the pumps, it is necessary to select an oil that will have the ability to withstand high pressures or high shearing action.

Since the hydraulic oil is the only medium that constantly is in contact with these closely machined assemblies, it must carry on the lubricating job by reducing friction to a minimum. Without high lubricating

Keeps the Piston ROD Clean
In Extreme Temperatures
SPRING LOADED WITH SQUEEZE GRIP Action
FALL WIPER RING
PATENTED & PAT. PEND.

Used During World War II and ever since by the Military

Fall Wiper Rings Spec. MIL-S-5049 are AN Approved.

Covered by patents issued and patents pending

In Use Since 1944

Squeeze Grip Action Does It —PATENTED

The 3-piece Fall Wiper Ring assembled into one piece as covered by patents consists of (1) a one-piece Split Wiper Ring (body) with two flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in the groove (3) an endless cover band surrounding the spring in the groove which causes a squeeze grip action on the piston rod.

The Fall Wiper Ring is available from ½" to 13" dia. Military part numbers from AN6231A1 to AN6231A71. Write, wire or phone us regarding your wiper needs.

Ace Products Company
Toledo 1, Ohio Phone ADams 6513

Fall Wiper Ring SPRING LOADED

VERSA Pilot VALVES

½ NPT SIZE SHOWN

COMPACT, EFFICIENT, RUGGED

To illustrate the compactness note the following sizes:

PIPE SIZE →	Width		Height		Length	
	⅛ & ¼	⅜ & ½	⅛ & ¼	⅜ & ½	⅛ & ¼	⅜ & ½
Two-Way	2"	2¾"	1⅝"	1 1/16"	4¾"	6 5/16"
Three-Way	2"	2¾"	1⅝"	1 1/16"	4¾"	6 5/16"
Four-Way	2"	2¾"	1⅝"	1 1/16"	6"	8 5/16"

Sizes are the same for both single pilot and double pilot types. Pilot outlets for all sizes are ⅛ pipe size and they can be rotated in 90 degree increments for convenience in installation.

Ideal for remote and sequence controls, timed cycles and solenoid operations, VERSA PILOT VALVES are available with single pilot-spring return or double pilot actuated (also double pilot with spring center in four-way type). Like VERSA hand, foot, and cam actuated valves, these PILOT VALVES incorporate important design features such as honest pipe size flow, balanced pressure spools and an exclusive anti-extrusion arrangement of kinetic "O" Ring Seals—all factors which ensure millions of cycles of air-tight, trouble-free performance.

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What a Good Hydraulic Oil Should Have

Continued

protection, parts would soon show excessive wear and impaired operating efficiency.

Chemical Stability

Hydraulic oils must be highly resistant to chemical change due to oxidation. When an oil goes through a chemical change, the composition of the physical properties produced are always different from those of the original material. As an example, a highly refined, light viscosity hydraulic oil can be changed rapidly to a gummy, non-lubricating substance by the action of oxygen. In turn, this can lead to the formation of corrosive materials.

To avoid the danger of these chemical changes, hydraulic oils must be made to minimize or retard whatever reaction may occur after they are placed in the hydraulic machinery. This is accomplished by the introduction of "anti-oxidants" in the oils during their compounding.

Rust Inhibiting Ability

An oil must be able to prevent rust and corrosion from attacking the highly polished interior surfaces in expensive equipment. In order to do this, a protective film must be formed over the metal surface, thereby reducing to a minimum the chance of any such formation. This is accomplished by the addition of certain rust-inhibiting chemicals that wet or plate the metal surfaces with a protective film which is impervious to moisture.

Demulsibility

Demulsibility is the oil's ability to separate quickly from water after such a mixture takes place. Most highly refined and treated hydraulic oils do have the ability to remain demulsified over long periods of time. Unfortunately, it is almost impossible to keep all moisture out of an enclosed hydraulic system and thereby completely prevent the formation of an emulsion.

It is well to bear in mind, that the ability of a new oil to separate from water is often lost rapidly during service. This is directly proportional to its resistance to oxidation and breakdown or contamination. It is for this reason that one must consider the type and treatment of new oils before judging them on the basis of demulsibility.

Non-Foaming Ability

Due to turbulence of flow through pump action or other mechanical effects in the system of a hydraulic machine, churning of the oil takes place. This in turn, causes the oil to mix with any air present, promoting the formation of foam. As a consequence, this results in erratic operation of the machine and, in extreme cases, can cause overflowing of the reservoir.

It is desirable that any foam formed should be broken up before it reaches the reservoir. This can often be done by correcting mechanical faults. However, when mechanical faults do not exist, a foaming condition can be reduced to a minimum by the addition of certain chemicals to the oil, during compounding.

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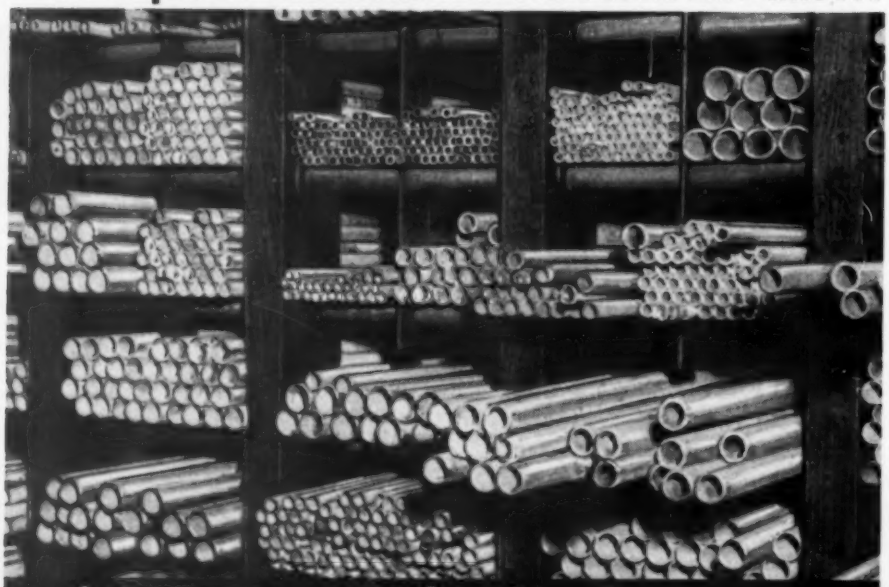

of Superior JIC hydraulic quality low carbon steel tubing

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Cincinnati, Pittsburgh

Compatibility

For proper long term performance, it is imperative that the hydraulic oil be compatible with every component in the entire system. This is particularly important in the matter of packings or seals.

Some hydraulic oils will affect the packings to such an extent as to severely shorten their service life. The result would be a loss of operating efficiency, a loss of oil and increased maintenance costs.

If the hydraulic oil you select has all the seven "desire-abilities" and they conform with requirements of your particular piece of hydraulic equipment, you have provided a safe and sound basis for the selection of an oil that will meet any and all demands that will be imposed upon it.

"Chill" Method Applied to Aircraft Parts

Reduced set-up and press time on heavy hydraulic machinery, such as the 8000 ton hydraulic press and 200 ton stretch press at Lockheed, has resulted from the use of a new chill technique. Lockheed Aircraft Corporation has put into operation a cavernous 5000 cubic foot ice box where metal can be kept in cold storage.

Larger than two box cars, the refrigerator deep-freezes metal plane parts to keep them soft—to hold their molecules in suspended animation—between two steps in fabrication.

Main benefits from the manufacturing freeze treatments are easier shaping, reduced breakage and smoother production flow.

Metal parts become soft semi-hard) when they are subjected to high heat in a process which, in the end gives them extra hardness and strength. If they are allowed to cool at normal room temperatures they harden rapidly. Such hardness would be a hindrance during forming and shaping operations. But, it has been discovered, quick-freezing keeps the metals soft indefinitely.

Measuring 40 by 12 feet and standing 11 feet high, the $20,000 ice box, three times as large as previous types, can cool 2500 pounds of aluminum from room temperature to minus 20 degrees Fahrenheit within two hours.

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TROSTEL mechanical packings and oil seals

Part 11 of a series on Fluid Lines

FLARELESS FITTINGS

By R. W. Phillips

Lenz "O" Ring Fitting

This fitting, because of its unique design, seals with very low torque. All the torque required is that necessary to hold the tube in place. The sealing is accomplished by an "O" ring.

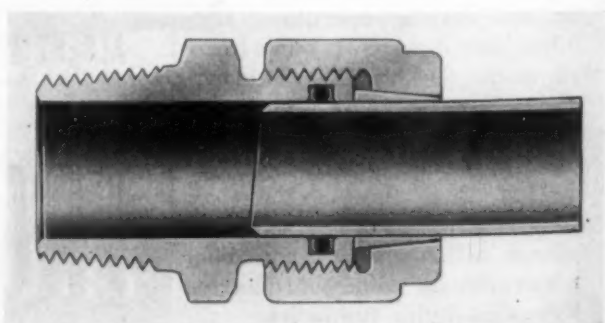
The fitting assembly consists of a nut, sleeve, an "O" ring and connector. The nut has a long taper which is designed to close down the split in the sleeve and grip the tube very tightly. The split sleeve acts as a collet. Its long taper reduces the torque required to get a very firm grip on the tube which prevents it from blowing out of the assembly.

The connector is recessed to provide space for the "O" ring. Originally, it had a tube stop, but that has been removed to permit the tubing to slide for straight line installations which could not be done otherwise. This works as follows: in a straight line installation the tubing is slid far enough into one connector to clear the other connector and is then pulled back to enter the cleared connector. Care must be taken not to misassemble. This is best done by pencil marking the tube for the minimum length which will cover the "O" ring and make a satisfactory assembly.

The tube is cut off and the outside edge must be burred to prevent the cutting of the "O" ring. Squareness of the end of the tube is not a factor. The tube is marked with a pencil to indicate the depth to which it is to be assembled in the connector. This step is necessary when the tube is installed in a straight position, but it is advisable in all installations. The tube is inserted to the mark, which will insure the tube end is past the "O" ring, and the nut is run down until some resistance to turning it is encountered. The assembly is then complete.

The following precautions should be observed. Be sure there is sufficient tube beyond the "O" ring to prevent the ring from being washed or blown out

Fig. 1. THE "O" RING fitting, shown assembled, is sealed by the deformation of the "O" ring under pressure; the tube is gripped separately by a split tapered ring. The tube need not be cut square but the outside of the tube must be carefully deburred.



of the groove. Be careful in burring the tube to be sure no burrs or sharp edges are present on the outside of the tube which may nick the "O" ring.

The principal advantage of this fitting is the low torque which is required for its assembly. There is no metal to metal seal; no exact tube length is required and there is no concentration of stresses due to flares or ferrules. The collet grips the tube with a torque which can be applied by hand in most cases. The principal disadvantage is the clearances which will exist unless selection fits are used. These clearances can be sufficient to allow extrusion, although this can be overcome to a certain extent by using harder "O" ring compounds. Another disadvantage is the fact that the assembly is a blind assembly and, unless the tubing is carefully burred, a nick may be produced in the "O" rings which will lead to leakage.

Sealastic Fittings

The Sealastic all-purpose fitting differs from most of the previously described fittings in that a rubber grommet is the sealing member and, in one version of the fitting, actually causes the steel sleeve to grip the tube and thus prevent blowoffs of tubing when under pressure. The fitting is manufactured by Chicago Forging and Manufacturing Company.

The Sealastic fitting is said to be shock-absorbing and vibration-fatigue proof. Elimination of any metal-to-metal contact prevents leakage or breakage in joints from severe or sustained vibration. Flexibility makes it unnecessary to obtain exact alignment of tubes to be coupled. Even if the tube is moved through an arc up to five degrees, the fitting provides a strong union and leakproof seal.

Figure 2 shows the relative position of the parts within the assembly. The fitting consists of four parts: (1) a compression nut; (2) a synthetic rubber seal or grommet; (3) a hardened ferrule or sleeve; and (4) a connector nipple. Sufficient tube clearance is provided in the connection and nut to assure against metal contact between the tube and fitting. The rubber seal ring covers the steel sleeve and seals the pressure against the sleeve, tube and connector when the fitting assembly has been made. The sleeve acts as a retainer and prevents the tube from being blown out of the rubber sealing member when pressure is applied.

Tightening the nut places the entire seal under compression, with the rubber ring acting as a cushion. A self-locking ferrule may be used for pressures up to 1000 psi, but a fixed ferrule is recommended for critical applications.

Tests have shown that, when only finger tightened, the fittings will withstand pressures up to 4000 psi. When wrench tightened, they will sustain pressure resistance beyond that of the tube itself. Temperature ranges from −70 to 400 F can be handled for special application.

The Sealastic fitting has a wide range of uses. It may be used for metal tubing or piping on oil, water, air, fuel, refrigeration or other lines under a broad range of temperature and pressure conditions. In addition to standard size fittings for straight, union, elbow, tee and cross connections, units are available

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not just in valve maintenance and service, but their leakproof characteristics take a load off your pumps, compressors and accumulators. We have seen cases where cylinders needed frequent repacking because of temperature build-up in the lines, and restricted or leaky valves were the cause.

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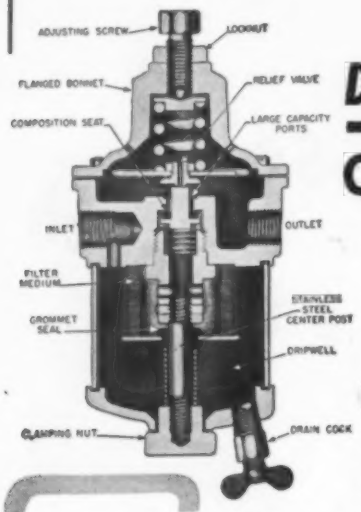

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Flareless Fittings

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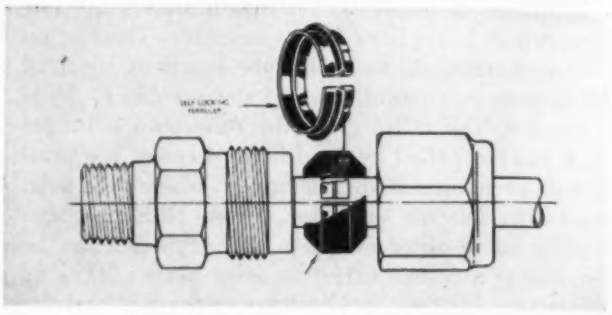

Fig. 2. RELATIVE POSITIONS of the parts within the Sealastic assembly are shown. The connection provides sufficient clearance to insure against metal-to-metal contact between the tube and fitting.

for forgings, integral fittings, prefabricated assemblies and other special applications.

The seal ring and self-locking ferrule come as an assembly ready for installation. The tubing is cut to length and burred internally and externally with as little chamfer as possible. The compression nut is placed on the tube with the serrated edge (indicated by a colored dot on the seal ring) nearest the end of the tube; the seal ring and ferrule assembly is then pushed into position on the tube. The serrated edge provides initial bite into the tube. The nut is then tightened on the connector. Excessive tightening of the connector nut can cause damage to the seal ring and diminish desirable flexibility of fitting without improving sealing efficiency. Such tightening is not necessary even with high pressures. It is vital that the seal ring be moistened or oiled before tightening.

To obtain the maximum benefit from the flexibility of the Sealastic fitting, directions for ferrule location and torque in the accompanying tables should be followed.

Table for Ferrule Location

Tube Sizes	1/8	3/16	1/4	5/16	3/8	1/2
Distance from center rib of ferrule to end of tube	3/16	3/16	7/32	7/32	7/32	5/16
Tube Sizes	5/8	3/4	7/8	1	1-1/4	1-1/2
Distance from center rib of ferrule to end of tube	3/8	3/8	13/32	7/16	15/32	1/2

Table for Proper Tightening

Tube Sizes	1/8	3/16	1/4	5/16	3/8	1/2
Number of turns beyond finger tight	1/4	1/3	1/3	1/2	1/2	3/4
Inch pounds	50	50	50-60	70	75	125
Tube Sizes	5/8	3/4	7/8	1	1-1/4	1-1/2
Number of turns beyond finger tight	3/4	3/4	3/4	3/4	7/8	1
Inch pounds	140	150	160	175	300	300

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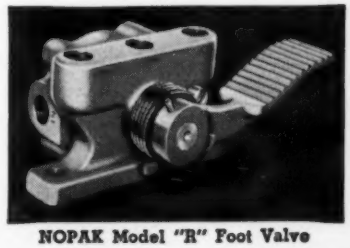
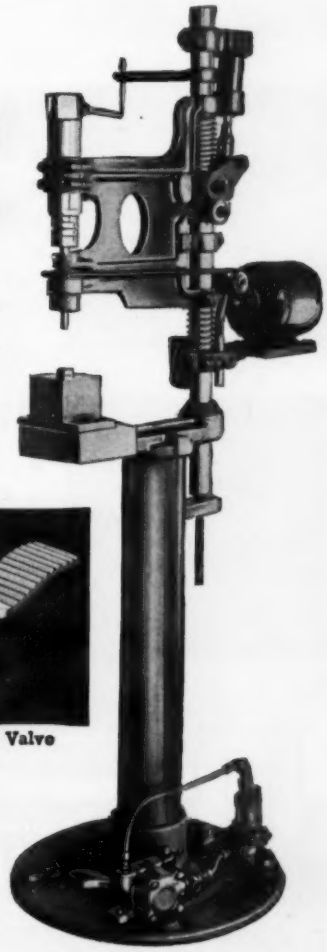
NOPAK 3- and 4-Way Foot Operating Valves are used in many ways on many different types of equipment for the precision control of air power applied to various machine movements. Ask your NOPAK representative to show you other examples in the NOPAK Application Manual.



NOPAK Model "R" Foot Valve



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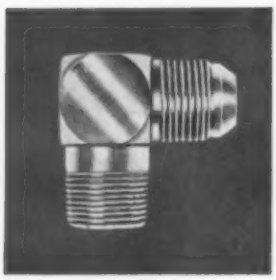

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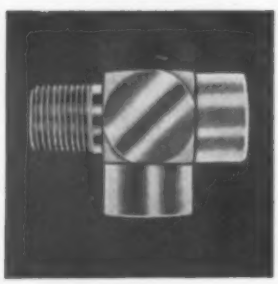

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Automatic Bleeding of Hydraulic Systems

Continued from page 64

scribed above in the brake system. The fluid flowing into the actuating cylinder also flows into the back of the bleeder valve. The pressure on the front and the back of the piston are thus balanced, keeping the exhaust port of the bleeder valve closed. The actuating cylinder can thus operate in the conventional manner. When the flow is reversed, however, to the other side of the actuating cylinder, the fluid can not return through the same line due to the check valve in the line. The pressure, therefore, pushes the piston in the bleeder valve against the spring pressure, uncovering the exhaust port, and allowing the fluid to complete its circular path to the reservoir. The piston in the bleeder valve can be pushed by the fluid in the actuating cylinder, because the pressure behind the piston has been removed when reversing the flow of the fluid. Any air trapped in the system will thus circulate and return to the reservoir, where it escapes to the outside air.

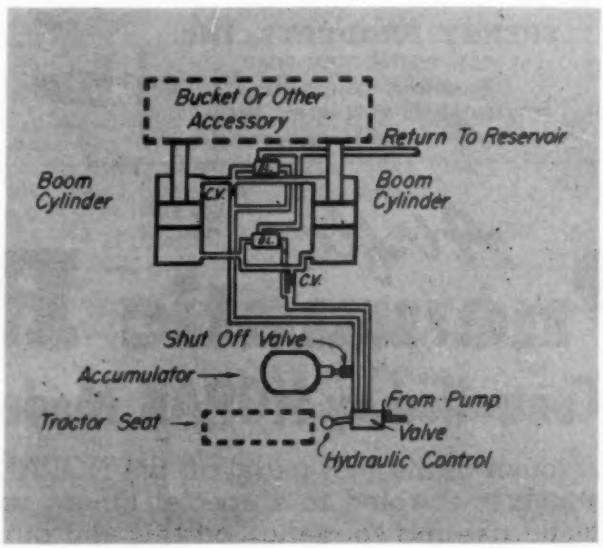

Fig. 7. Self bleeding hydraulic systems for bucket loaders and power shovels.

Single acting cylinders require one bleeder valve. Double acting cylinders require two bleeder valves—one at each port. The exhaust ports of the two bleeders are connected, and only one return line to the reservoir is required. In most cases the exhaust ports of all the bleeder valves in the installation can be connected to a common return line to the reservoir.

In most cases, the length of the return line from the bleeder valve to the reservoir is no longer than the return line from the reversing valves to the reservoir, which are no longer required. There is, therefore, little if any additional tubing required in most industrial applications when converting to a self bleeding hydraulic system.

Even in aircraft applications, where the tubing is very long, the added return line from the bleeder valves

is almost completely compensated for by the removal of the return lines from the reversing valves. Also the small addition in weight is more than compensated for by the greatly reduced maintenance and increased safety which is so important in aircraft operation.

One of the interesting features of the self bleeding hydraulic valve is that in addition to bleeding the air back to the reservoir, it also tends to circulate any moisture, gum and sediment out of the system, and deposit them in the reservoir, where they do no harm. Thus the automatic air bleeding valve performs not only its air bleeding mission, but also accomplishes other things, above and beyond what was initially sought after in the development of this hydraulic system.

Oil Expanded Bag Lowers Metal Forming Costs

Concluded from page 22

employed for piston operation is "saftied" at a maximum pressure of 400 psi. "Greater ejection pressures than this may deform or injure the tank," an engineer explained.

The hydraulic pressure bag is mounted over a mandrel which in turn is attached to the mold cover. The presence of this internal mandrel reduces hydraulic oil requirements during sizing to approximately 25 gallons. Quick-acting clamps are used to hold the mold cover in place. A one-ton air hoist above the tool is used to insert the mandrel and bag, and to extract it from the tank after final sizing is completed.

In the sizing operation, the welded and heat treated tank is removed from sub-zero storage, then coated with No. 302 draw-press compound. A strip of paper is then wrapped around the top edge of the tank to prevent possible galling that might result from the similarity of the metal in both the mold and part (both being an aluminum alloy). The tank is placed in the mold and the mandrel-bag-cover combination is lowered into it and locked in position by quick-acting clamps. Two index pins with spin nuts are employed to accurately position the cover on the mold.

PRIZE PAPER AWARDS . . .

for the first APPLIED HYDRAULICS Contest, which ended June 1st, will be made shortly after the judges complete their study and grading of all entries. Winners of the $1200 in prizes will be notified by letter.

Hydraulic oil is then pumped into the bag to expand it and force the tank metal to conform to the contours of the mold. A bag pressure of from 350-450 psi is accumulated in about three minutes. Due to initial accuracy of manufacture, tank metal elongation during this stretch-sizing operation does not exceed 6 per cent.

The time required to accurately size and contour a tank is about five minutes floor-to-floor. Using conventional hand-contouring techniques with continual template comparisons required about 50 minutes per tank.

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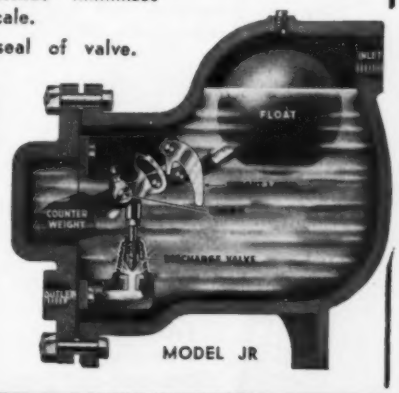

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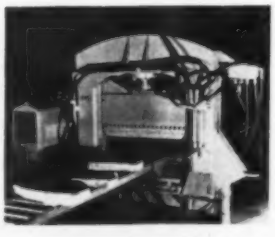

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Accumulator Selection

Concluded from page 59

$$P_2 \times V_2 = P_3 \times V_3$$
$$P_2 \times 367 = 650 \times 427$$
$$P_2 = 755 \text{ } psi$$

Solve for unknown P_1

$$P_1 \times V_1 = P_2 \times V_2$$
$$P_1 \times 550 = 755 \times 367$$
$$P_1 = 505 \text{ } psi$$

In this example study, a nitrogen precharge pressure $P_1 = 515$ psi should be established. The pressure reducer control of oil influent to the accumulator should be set at $P_2 = 770$ psi. This should guarantee 350 hours of high speed cycling before the loss of nitrogen by osmosis through the bladder would exceed 10% to 460 psi and require a service refill of nitrogen.

Over 80 per cent of satisfactory industrial high speed accumulators operate at a P_2 value under 1,000 psi. In known cases of P_2 at 3,000 psi and a ΔV at one tenth instead of one twenty-seventh of V_1, the rate of nitrogen osmosis accelerates to require a nitrogen recharge every twenty operating hours.

It is our hope that the realization of the benefits to be derived by use of "THE RULE OF THREE" will help you to eliminate some of the unknowns in your accumulator installations and thus improve your operation efficiency and decrease your maintenance cost.

Oil Powered Jacks

Continued from page 61

nected in parallel to the pressure oil, rotate the nuts through a chain drive, as the threaded rods and upper cross-member of the jack move. On the up-stroke, the bottom nuts rotate downward to maintain contact with the lower cross-member of the jack. The upper motor is stalled by the load acting on the top nuts. After the jack has completed its lift stroke, it is spring returned. The lower nuts now carry the load and the upper motor rotates the upper nuts downward to maintain contact with the retracting cross-member. This jacking cycle is repeated until the slab is in position. Each fluid motor takes .378 cu in of oil per revolution.

The travel of the nuts on the threaded rods is used to gauge the lift, nut rotation actuates an electrical counter at the operator's panel to indicate movement. Lift can be controlled within .083 inches.

Oil power is supplied to the control console and then to each jack by a pumping unit located at ground level. This power unit uses a 15 hp double ended motor. On one end is a 7 gpm, two stage, 2000 psi vane pump which powers the jack cylinders. The other pump, a 1000 psi, 5 gpm vane pump supplies the fluid motors. These pumps and motor, with proper relief valves, are mounted on a 40 gallon oil reservoir.

High pressure hose lines carry oil from the power package on the ground to the console on the slab.

Hose lines radiating from the console to each jack give the top of the slab the appearance of a spider web.

The application of the lift-slab method on the Los Angeles located building, shown in the photograph, trimmed $44,000 from the original $235,000 budget based on conventional building techniques and reduced by 25 per cent the time required to complete the job.

Pioneered in 1950, the system is known as the Youtz-Slick lift-slab concrete method. It was developed by Phil Youtz, a New York architect, and Tom Slick, wealthy Texas oil man, who pooled their ideas and patents and turned the project over to the Southwest Research Institute in San Antonio, Texas. With the help of its sister organization, the Institute of Inventive Research, Southwest developed the idea, into its present practical form. All licensing operations of this construction method are controlled through the Institute of Inventive Research.

Increasing Compressed Air Capacity

Concluded from page 65

driven by a flanged type 125 hp, 585 rpm integrally mounted electric motor. The air receiver on the new unit is a 42 inch x 10 foot vertical unit. Maximum operating pressure 115 psig, with a maximum safety valve setting of 125 psig.

Proper conditioning of the air is accomplished with a horizontal type aftercooler having an automatic condensate trap. The inlet to the compressor is from an 8 inch line extending through the factory roof into comparatively clean air condition with a filter at the inlet.

The output line size is 5 inches from the receiver to tie into the main plant system. The compressor and aftercolor are supplied with the city pressure at 30 psi through a ¾ inch line to the compressor and a 1 ½ inch line to the aftercooler. Both lines are throttled to hold about 100°F. on the compressor and 85°-90° on the aftercooler. At the present time, this water is drained direct to the storm sewer system, but it is contemplated using this water to feed three wet type dust removal machines in the near future.

No changes were made in the old distribution system, except in areas where the old buildings were razed and it was necessary to install feeder lines into the new buildings. The 5 inch feed line from the new system was tied into the old system, so that the latter could operate as a standby.

All air connections to benches, air tools and machines are fed through ½ inch pipe lines and these terminate for the most part in couplers which permit quick connecting and disconnecting of air hose.

Monarch uses compressed air to operate chucks, cylinder and oiling devices on machine tools; pneumatic power equipment to move machine components on the beds for determining bearing during aligning process; small hand tools; paint spray systems; pneumatic control on heating and air conditioning systems; air control on tracing equipment; and air gauges and air measuring devices.

Circle 26 on Reader Service Card

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Circle 19 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Joseph M. Devine
Control Engineering Corporation

Borje Rosaen
Hydreco Division,
The New York Air Brake Company

James E. Duff
Cuno Engineering Corporation

The national sales representatives of **Control Engineering Corporation,** Norwood, Mass., met recently in New York for the company's first general sales meeting. Chairman of this sales conference was **Joseph M. Devine,** who joined Control Engineering recently as sales manager. Previously he was sales manager, Process Controls Division of Baird Associates. In addition to company executives **W. A. Jones, George S. Cherniak** and **Byron White,** present at the meeting were Earl Lipscomb, Dallas; E. G. Byers, Houston; Sydney S. Lee, Washington, D. C.; Edward A. Ossman, Rochester; Robert S. Siff, Dayton; Sy Sterling, Detroit; Robert A. Waters, Waltham; James Everett, Chicago; Frank Gates, Salt Lake City; C. E. Ault, Los Angeles; J. T. Hill, Los Angeles; Warren Huth, H. E. Ransford, Pittsburgh; and Robert C. Iseman, Binghampton.

James E. Duff, who has been advertising and sales promotion manager for the past year and a half, was appointed Eastern District sales manager of the **Cuno Engineering Corporation,** Meriden, Connecticut.

Borje Rosaen was appointed sales manager of the **Hydreco Division, The New York Air Brake Company,** Cleveland, Ohio. Rosaen continues as sales manager for the Dudco Division at Hazel Park, Michigan, of which he was one of the founders and which became a division of The New York Air Brake Company in 1951. The sales functions and product lines of the Hydreco and Dudco Divisions are very closely related.

Republic Aviation Corporation named **Donald M. Parker, Jr.** as assistant director of the company's European division. Parker will be located in Paris, France, where he will assist **Robert Kinkaid,** Republic's European director, in liaison work between the company, the United States Air Force and nine European nations of NATO.

Harold Granger, eastern regional manager of **The Bellows Company,** Akron, announced the appointment of three field engineers to service territories with the following headquarters: **R. C. Smith,** 1447 Main Street, E., Rochester, N. Y.; **Aaron I. Kutz,** 70 East 45th Street, New York 17, N. Y.; and **Robert E. McClure,** 307 United Building, 43 Leon Street, Boston, Mass.

Oliver G. Dumont has been named superintendent of the electrical departments at **Allis-Chalmers** Norwood (Ohio) Works, succeeding **G. C. Vogel,** who recently became general superintendent. Also announced was the appointment of **John D. Faul** as night superintendent of Plants 1 and 2 at Norwood.

Linear, Inc., Philadelphia, appointed **Leander Sales Co. Ltd.**, Montreal, as a distributor for their products in Canada. Leander Sales Company is under the management of **Jack Anderson.**

The Bush Manufacturing Co. of West Hartford, Conn., and the **Heat-X-Changer Co.** of Brewster, N. Y. have announced the opening of new warehouse and branch office facilities in Chicago, Illinois. Comprising 6.-250 square feet of floor space the new warehouse is located at 1455 West Congress Street. In charge of the office force and sales engineers in the field will be **J. K. Campbell,** Midwest district manager for Bush and Heat-X-Changer.

A new division has been set up by **Standard Pressed Steel Co.**, Jenkintown, Pennsylvania, to manufacture and sell a new product, a self-locking spring-pin fastener. The fastener called the Sel-Lok spring pin, replaces tapered grooved and dowel pins in all kinds of assemblies. SPS set up the new division after buying the production machinery, inventory, patents pending and other assets of the Self-Lok Fastener Corporation from the Raft Machine Company, of Belleville, New Jersey early this year. General manager of the new division is **James F. Regan,** who was vice president of the Self Lock Fastener Corporation.

New assistant to L. B. Littrell, vice president-aircraft and engines, at **Pacific Airmotive Corporation,** is **William Maxfield,** formerly director of maintenance and engineering for Braniff Airways, Inc. New Burbank aircraft division manager is **Galen Potter,** former assistant manager for AiResearch Aviation Service Company. Mr. Potter replaces **H. Y. Finley,** who was recently elevated to vice president. **Robert D. Brahm** was advanced to assistant division manager at PAC's Chino plant, replacing **Ed Kirby,** who was transferred to Burbank Aircraft Sales.

The **Cleco Division** of the **Reed Roller Bit Company,** Houston, Texas, appointed **F. C. Bishop Co., Inc.,** P. O. Box 21, Sta. H., Buffalo 14, N. Y.; **Flood and Calvert, Inc.,** 2314 Strand, Galeston, Texas; and **Paterson Machinery Company,** 309 Seventh Avenue South, Nashville 4, Tennessee, as distributors for Cleco products in their areas.

Dr. Leland M. White has been appointed assistant director of the research and development department of **United States Rubber Company.** Dr. White joined the department in 1940 and has been head of the rubber applications department at the Passaic, general laboratories since 1947. He is succeeded in the latter position by **Dr. B. C. Barton.**

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HYDRO-WYPE AN-6231-A SCRAPER RINGS

Our Hydro-Wype Scraper Rings wipe piston rods clean of dirt, dust, ice, shavings and foreign materials to prevent damage to "O" or "V" ring packings, cylinder walls, etc. Made to highest precision standards. Pre-stressed design assures metal-to-metal fit with minimum interference and breakout pressure. Tested and proved at over 2,000,000 cycles—*more than 20 times the requirement under MIL-S-5049.* Successfully used in hydraulic or pneumatic cylinders and actuators, aircraft controls and many other applications. Write ATSCO for complete catalog.

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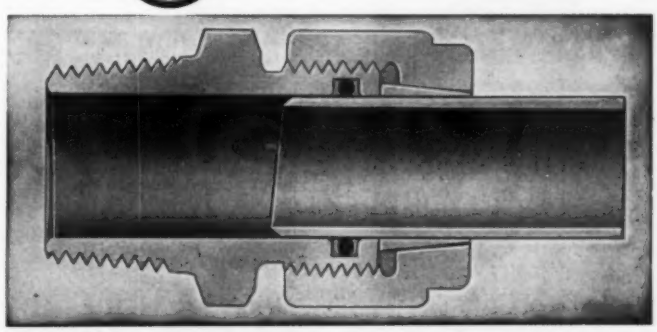

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Post Scripts of Industry

Continued

T. M. Cole, president of **Federal Electric Products Company** of Newark, N. J., announced that a new manufacturing plant, now under construction in Scranton, Pa., is scheduled to begin operations in September. The three million dollar plant will consist of an ultra modern one-story industrial structure covering 132,000 square feet, with an adjacent administration and research building of 30,000 square feet and will employ 650-750 persons.

The combination of **Allis-Chalmers** district and branch office territories of Denver, Salt Lake City, Phoenix, El Paso, and Spokane into the Rocky Mountain Region with headquarters at Denver, has been announced. **Richard D. Moody,** since 1950 manager of the Los Angeles district office, has been appointed manager of the new region. Successor to Moody as manager of the Los Angeles office is **Richard L. Engel,** who has been associated with the company since 1939.

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POROUS STONE

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IN YOUR COMPRESSED AIR LINES

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2 They actually FILTER the air through the innumerable zig-zag pores of the stone of the tiniest particles of extraneous matter.

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TWO STONES—2" in thickness but of varying diameters to fit different filter sizes—supplied with each Filter unit.

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Paul Feeger has been assigned to the Albuquerque industrial sales and engineering staff of **Minneapolis-Honeywell Regulator Company.** Feeger, who transferred from the firm's Denver office, will specialize in the sales and service of products of the company's Industrial and Valve Divisions.

George C. Somes, Jr.
Standard Pressed Steel Co.

George C. Somes, Jr., manager since 1944 of the New York City sales territory for **Standard Pressed Steel Co.,** Jenkintown, Pa., has been named manager of sales promotion and merchandising. In his new post he will have charge of training courses at the Jenkintown plant and in the field for distributor salesmen and personnel. He will have his offices at Jenkintown.

Joseph K. Strickland and **Joseph P. Foley** have been added to the Baldwin testing equipment sales staff in the New York City and Cleveland areas respectively to expand field service of **Baldwin-Lima-Hamilton Corporation,** Philadelphia, Pa. Strick-

land was formerly sales engineer, Industrial Products Division of Johns-Manville and Foley was applications engineer for electric industrial equipment handled by Sterling Motors, Inc.

Frank E. Reeves
Automatic Switch Company

In order to expand its West Coast service, **The Automatic Switch Company** of Orange, N.J. opened a factory branch at 923 East Third Street, Los Angeles 13, California. **Frank E. Reeves** has been chosen to head the Los Angeles sales engineering organization. Reeves has a strong background in both the power and control fields. He has been associated with consulting engineering firms, utilities, and industrial companies as an electrical design engineer and has had experience with all types of control problems.

Globe Machinery and Supply Company, 309 8th Avenue, S.E., Cedar Rapids, Iowa, has been named distributor for O-rings manufactured by the **Parker Appliance Company,** Cleveland.

Two changes involving engineering personnel at Rosan Inc., of Newport Beach, California, were announced by **Jose Rosan,** company president. **Robert D. Weber,** for several years chief engineer of Rosan Inc. and Rosan Engineering Co., has been promoted to the position of director of engineering for both companies. **Arthur I. Lusk,** formerly assistant to **John K. Northrop** and director of guided missile development of Northrop Aircraft, Inc. was appointed chief engineer for both organizations.

Hayes Pump & Machinery Company has moved into new headquarters at 100 Vine Street, Summerville 43, Mass.

Transfer of headquarters and sales offices of its Pioneer Pump Division to 2750 Guardian Building, Detroit, Michigan and transfer of manufacturing operations to a new plant in Paris, Kentucky, has been announced by J. Thomas Smith, president of **Detroit Harvester Company.**

W. H. Rowand, chief engineer of the Boiler Division of **The Babcock & Wilcox Company** has been elected as vice president of the company. He will continue to hold the post of divisional chief engineer.

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New Packings Manual Includes JIC Code

The new 60 page Packings Catalog and Manual 201, covering their complete line of leather and synthetic rubber packings, has just been issued by Graton & Knight Company-International Packings Corporation. The Manual section presents basic data on standardization of packings, types of mechanical packings, cup, flange, U and V packings applications. This is the first major packing company catalog which lists the new JIC Packing Code Identification (February, 1953) and tables of nominal sizes for all leather and synthetic rubber packings in accordance with JIC Recommended Practices.

The Manual section reproduces some data from the Graton & Knight Company's Mechanical Packings Manual; additional data has been added on the newer materials and techniques. Six basic types of packings are treated in detail with design suggestions, application sketches and installation notes.

The Leather Packings section reviews the advantages of this material, sketches the processing and the manufacture of leather packings and gives information on special impregnants and costings. Specification data on each type of standard leather packing (cup, flange, U and V) and on a number of special leather seals are given. Complete tables of nominal sizes for standard packings in accordance with JIC Recommended Practices, recommended proportions for design and directions for ordering both standard and non-standard packings by JIC code letters are given. A list of factors to include when ordering any type packing is included.

In the Synthetic Rubber Packings section brief but authoritative data on the properties and outstanding characteristics of natural and synthetic rubbers is listed; tables specify general properties, ASTM physical requirements of compounds and AMS specifications. Manufacturing procedures of homogeneous rubber packings are outlined, including finishing, inspection, packing and shipping. There is a practical section on the applications and uses of "O" rings. Complete specifications are given for operating rings OV class —IPC 27), static rings (OC class —IPC 30), recommended groove dimensions, leather back-up rings, oil resistant rings (AMS 7274 or IPC 123), gaskets, U and V packings, adaptor rings (JIC Recommended Practice), special packings and oil seals of both leather and synthetic rubber.

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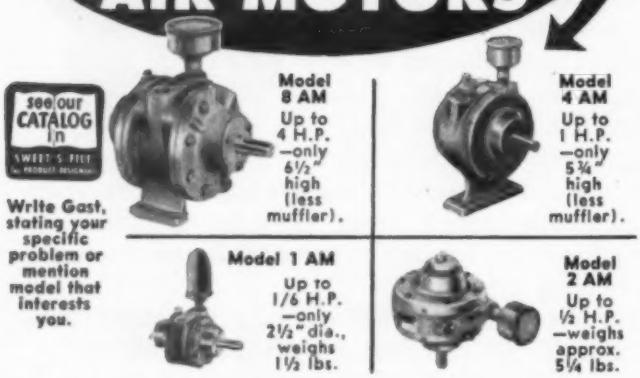

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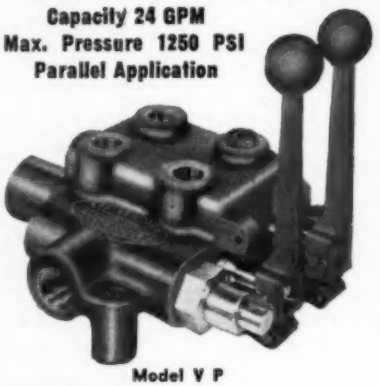

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SCRUBS, CLEANS AND DRIES
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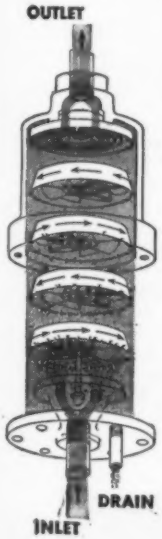

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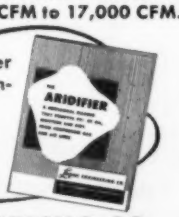

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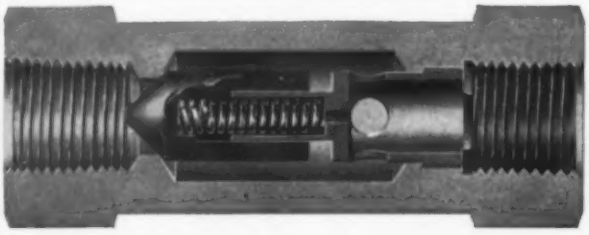

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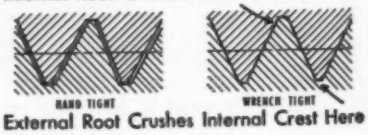

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